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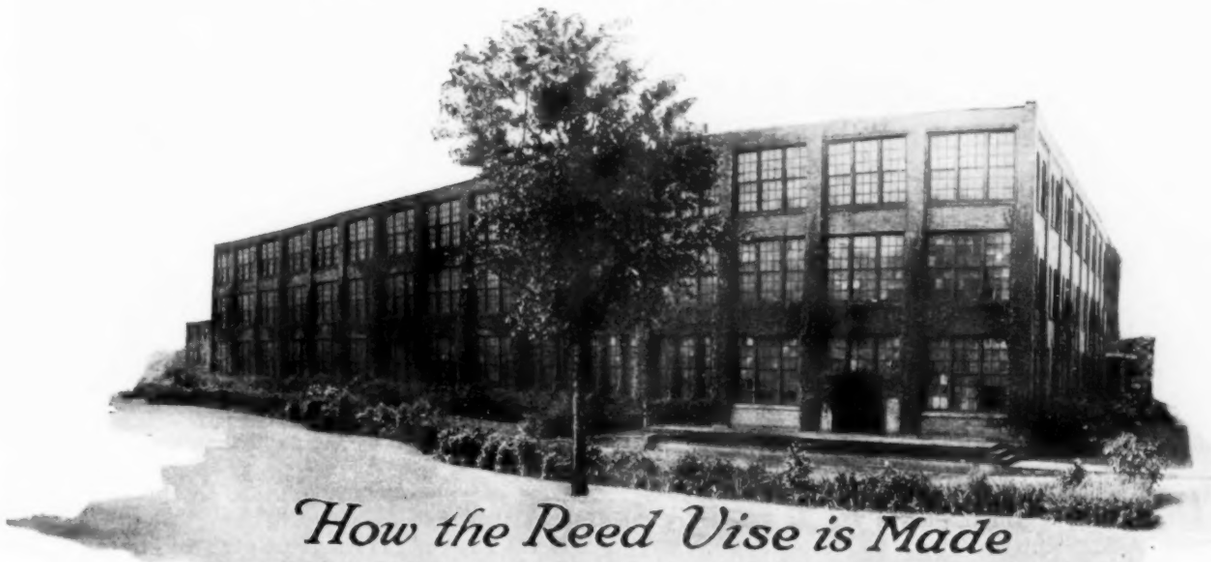


How the Reed Vise is Made

By J. V. Hunter

The machinist's bench vise is so common an implement that it is often treated with anything but respect, and it must be sturdy enough to withstand such treatment and at the same time be capable of perfect work under the hands of the expert. If careful planning, modern machinery and attractive surroundings are of use in improving a product, the vise described and illustrated should be successful.

THE old bench vise was essentially two heavy cast-iron blocks which were ground, filed and hand fitted until they worked together in a more or less satisfactory manner. In case of breakage neither part could be replaced because standardization was unheard of. The careful machining operations used in the production of the vises made by the Reed Manufacturing Co., Erie, Penn., indicate the development of their manufacture with a view to obtaining interchangeability of parts and at the same time including the idea that the better a piece is made the better care it will receive throughout its life.

Upon delivery to the shop from the foundry the castings are placed in box trucks, Fig. 1, to reduce the amount of handling. The shop has built all its own trucks and their wheel bearings and it uses hundreds of them, but enough are always on hand so that the workman after putting the parts through a machine operation can drop them immediately into a waiting empty truck to be transported to the next process.

The first machine operation on a vise body is that of broaching the hole for the sliding-arm, for which a La Pointe broaching machine is used, which eliminates all of the old hand clipping and filing on this part and insures a true bearing surface at every point. The vise body is laid on blocks before the head of the broaching machine, Fig. 2, and finished in a single operation.

The main nut for the vise-jaw screw which fits in the base of the body is located in a close-fitting dovetailed slot milled out by the special device shown in Fig. 3. This is built on a milling machine and consists of a

FIG. 1. TRUCKS USED FOR HANDLING PARTS

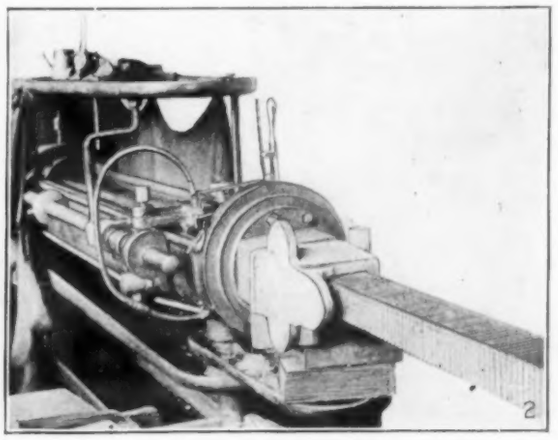


FIG. 2. BROACHING THE VISE BODY

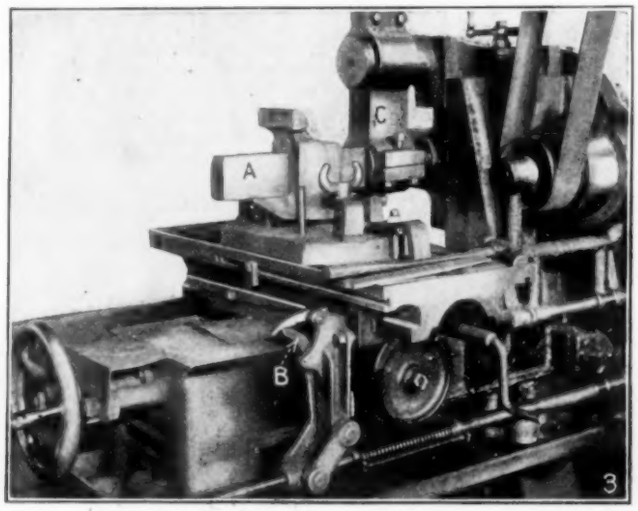


FIG. 3. DEVICE FOR MILLING DOVETAIL SLOT

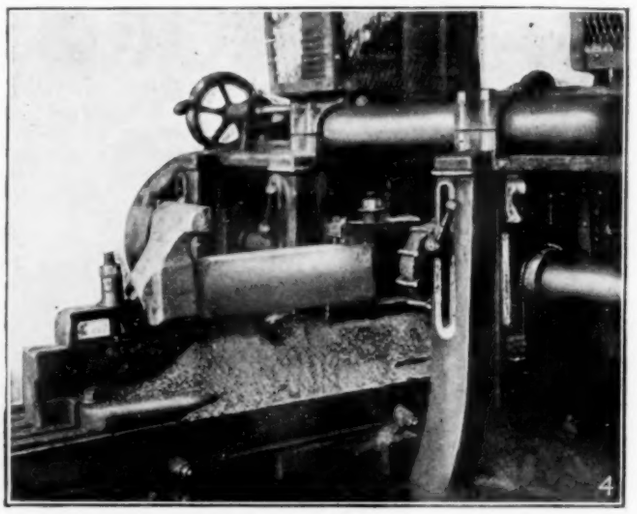


FIG. 4. MILLING SIDES OF THE SLIDING-ARM

large square arbor *A* which fits through the hole in the body of the vise. On the lower face of this arbor is a small milling cutter driven by suitable gearing from the spindle of the milling machine. The cutter is advanced into the work by the feed of the table until it reaches a point where the finger *B* of the automatic tripping device falls into place and stops the cut. It will be seen that the square arbor *A* is supported by a heavy arm *C* which hangs from the overhead arm of the milling machine. This arm carries all of the weight of the arbor, so that none will fall on the spindle which drives the milling cutter.

The square sides of the arm of the sliding-vise jaw are carefully milled to finish in one cut on a double-end milling machine, Fig. 4, fitted with cutters with inserted high-speed steel teeth. The two sides of the arm are finished first, and the arm is then moved to a second machine of similar character where the two edges are milled.

The end of the jaw which holds the head of the clamping screw is milled with a triplex cutter to finish three surfaces simultaneously. For this, Fig. 5, the sliding jaw is mounted in a fixture on a milling-machine table directly in line with the spindle. This cut cleans out the hole for the screw with the cutter *A* and finishes the inside bearing surface *B* by means of an end-mill cutter which is not visible. The large outside cutter *C* finishes the edge of the shield which protects the screw-head bearing from chips and dirt.

A series of drilling processes on the base of the main vise body are conducted on a gang-drilling machine which is handled by a single operator who passes the body successively through the three operations. In the first of these at *A*, Fig. 6, the body is held on a wedge block so that the drill may enter at the required angle; for the second the body is slipped on a square mandrel *B*, a drill-jig plate with aligning lugs serving as a guide while the large bolt holes are drilled in the base, and the third it is held on a square mandrel *C* while the third spindle of the gang drill performs its work.

The preceding methods will practically complete the parts of the plain vise for assembly, and these are now fitted together before the subsequent finishing operations of milling the jaws, the first of which, Fig. 7, is performed on a milling machine carrying on its spindle the two inserted-tooth cutters *A*, which finish the ends of the jaws to length.

Carbon steel is used for the inserts of these milling cutters because the jaws of these vises are formed of tool-steel plates which are cast in place. These plates

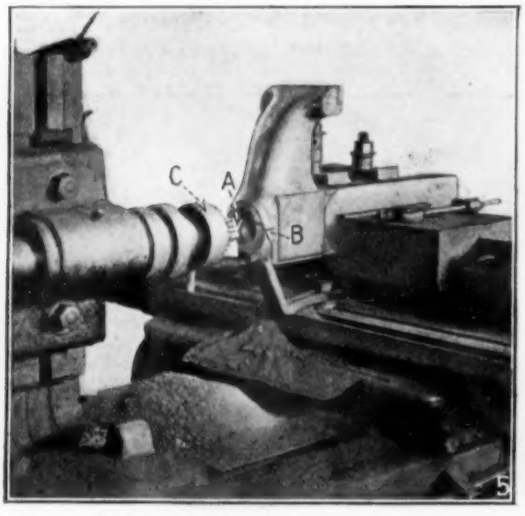


FIG. 5. COUNTERBORING END OF JAW

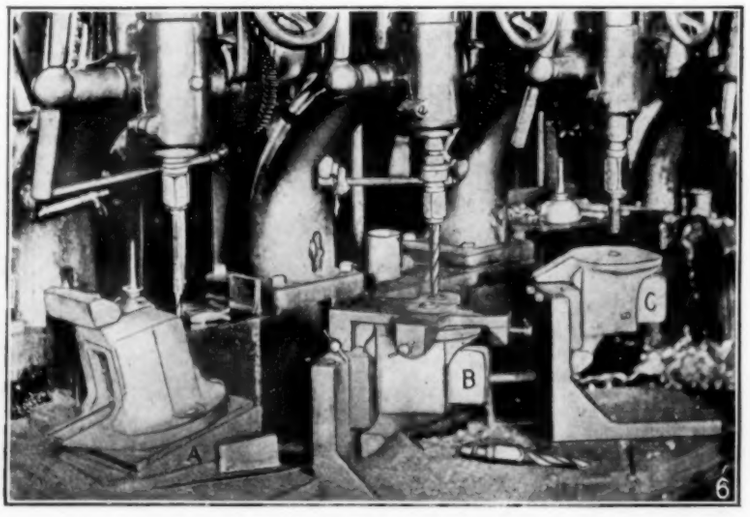


FIG. 6. DRILLING THE BASE

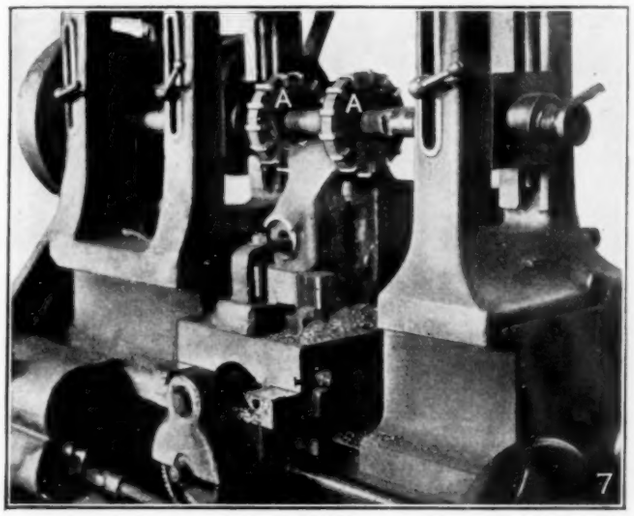


FIG. 7. MILLING THE JAW ENDS

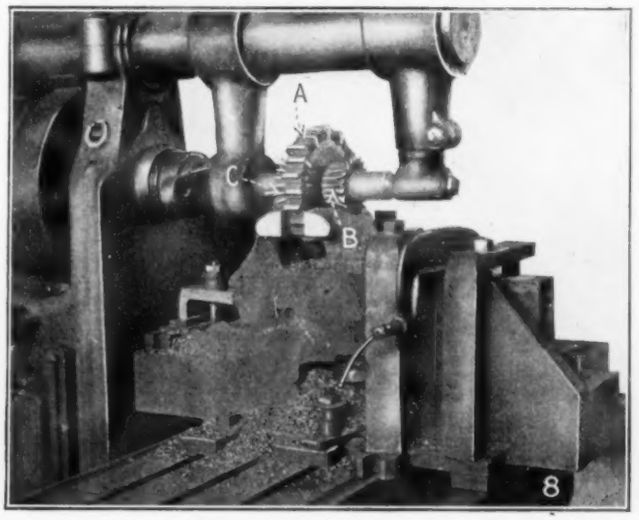


FIG. 8. MILLING THE JAW FACES AND TOPS

may act as chills on this portion of the casting and form hard spots. The result is rather destructive to milling cutters and it has been the experience of the Reed plant that it is better economy to use cheaper carbon-steel inserts and run at a slower speed than to pay for the replacement of high-speed steel inserts, which would be broken by contact with these hard spots.

The inside faces of the jaws are finished true and parallel by the milling cutter *A*, Fig. 8, and at the same time the form mills *B* and *C* finish the top surface of the jaws to a uniform contour. It will be noticed that the blades of the main milling cutter *A* are arranged to cut alternately on the left- and right-hand jaws and thus they are still useful when they have been worn and ground shorter than the thickness of the body of the cutter.

In the production of the swivel-jaw, swivel-base vise the milling-machine fixture, Fig. 9, mounted on the rotating table is used for machining the base to the correct radius to fit that of the swivel jaw. The swivel base *A* previously broached for the sliding-jaw arm is mounted on the rectangular mandrel *B*. The first point milled *C* is cut by the three faces *D*, *E* and *F* of the milling cutter. On the completion of this cut the spindle is raised and the table is moved sufficiently to bring the work in line for the cut shown. When lowering the milling-cutter spindle to the correct depth for making this cut it is gaged for position by means of plugs which are inserted between the finished surfaces of stop lugs that are attached to the spindle head and to the frame of the machine at the point *G*. This arrangement is further detailed in Fig. 10, which shows the moving stop lug *A* on the spindle head and the stationary stop lug *B* which is attached to the frame of the milling machine. By the insertion of different lengths of plugs *C* between these two stops it

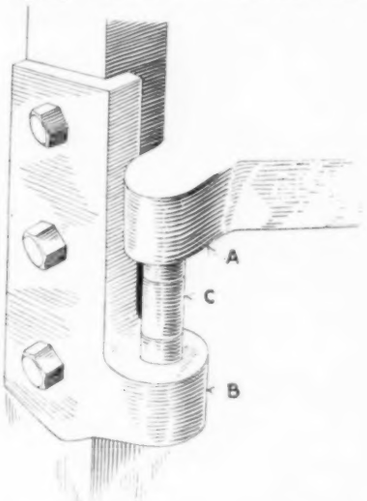


FIG. 10. STOP LUGS AND BLOCKS FOR HEIGHT ADJUSTMENT

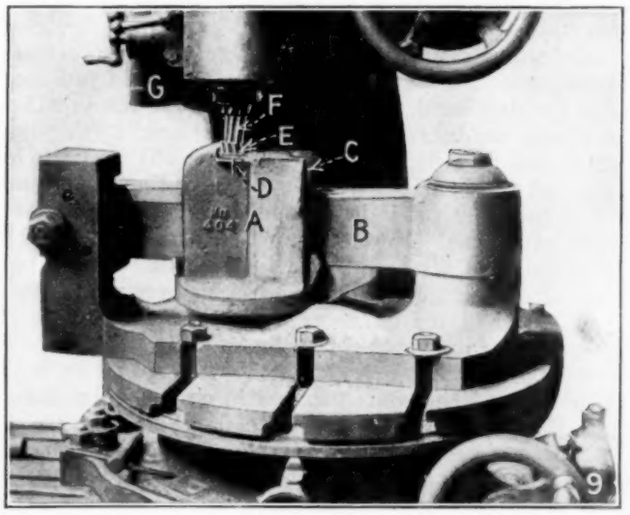


FIG. 9. MILLING THE SEAT FOR A SWIVEL JAW

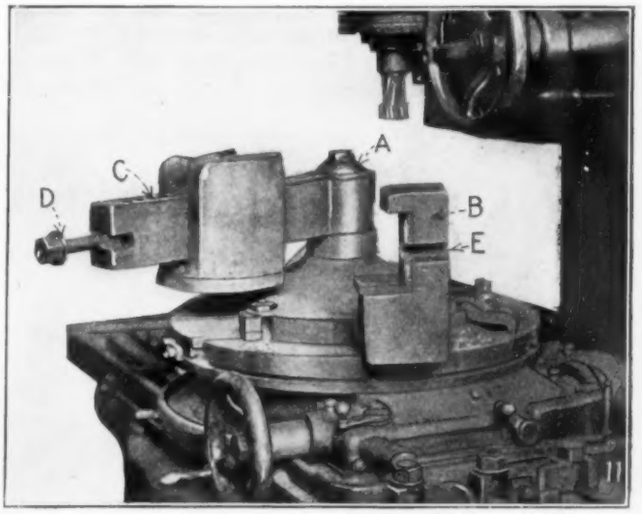


FIG. 11. FIXTURE FOR MILLING BODY OF SWIVEL JAW

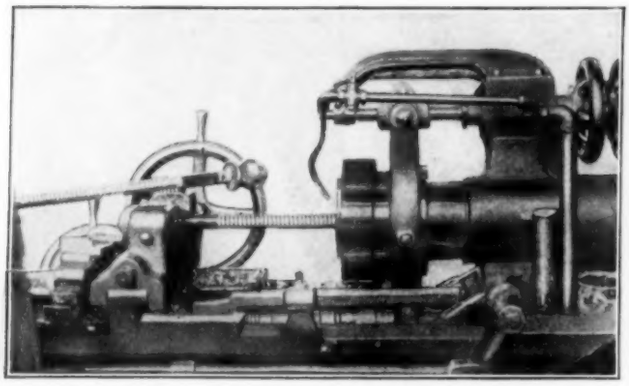


FIG. 12. CUTTING THE SCREWS

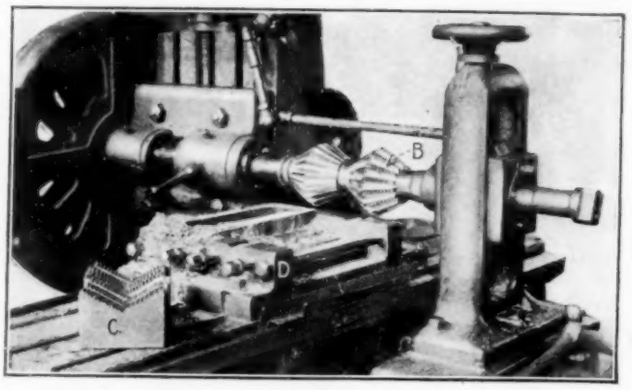


FIG. 14. MILLING PIPE JAWS

is possible to bring the spindle head down repeatedly to any predetermined depth of cut. This arrangement is used both on the spindle head and on the movement of the table when positioning it for making the two cuts.

The arrangement for holding the swivel body on the square mandrel and its quick removal from this fixture is shown in Fig. 11. This arbor, which is swiveled at the end *A*, is swung out from the locking block *B* for placing the vise body, and has a number of holes *C* in its upper face in which plugs may be inserted for stops for different styles for vise bodies. The arbor is swung back under the locking block *B* and clamped into position for the machining by swinging the eyebolt *D* into the slot *E*.

Cutting the Threads

The operation of cutting the modified square thread on the screws for these vises is performed on a standard bolt cutter, Fig. 12, in two cuts, a rough and a finishing cut being used to insure the completion of a satisfactory thread.

Mention has previously been made of the slot milled in the base of the body of the vise for receiving the main nut. The base of this nut is also milled to limits which insure interchangeability in a special fixture, Fig. 13, which holds four nuts at a time. The fixture, as shown, has two nuts in position at the rear, while the front is empty, and one of the nuts is shown at *A*. A combination milling cutter *B* is used, which faces off the bottom of the nut with the large inserted tooth cutter, while the solid bevel section finishes the sloping side. There are two sets of these cutters to cut simultaneously on both sides of the holding fixture. After the nut has been through for the first cut it is turned over and placed on the other side of the fixture for the second cut. It will be observed that a round mandrel *C* is placed through the tapped hole in the nut in order to line it up with the base.

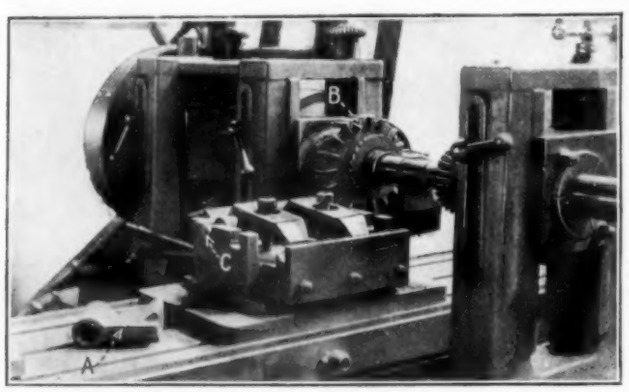


FIG. 13. FINISHING BASES OF THE UNITS

The combination vises are fitted with pipe-holding jaws made of tool steel. These pieces are sheared from the bar, and after being squared up they are put through a milling operation, Fig. 14, for making the V-notch. The milling-machine spindle carries two cutters, the first for roughing out the V-notch, the other cutter *B* for milling the serrations in the blocks. The results are shown at *C*. A plain clamping fixture *D* is used, which is loaded on both sides so that as fast as the pieces are through the first operation they are transferred for finishing by the second operation. The same fixture is used for both the long and short jaws, parallel blocks being put in its base for raising the short blocks the required height to meet the cutter.

Typical Metal Fittings at Aëronautical Exhibition

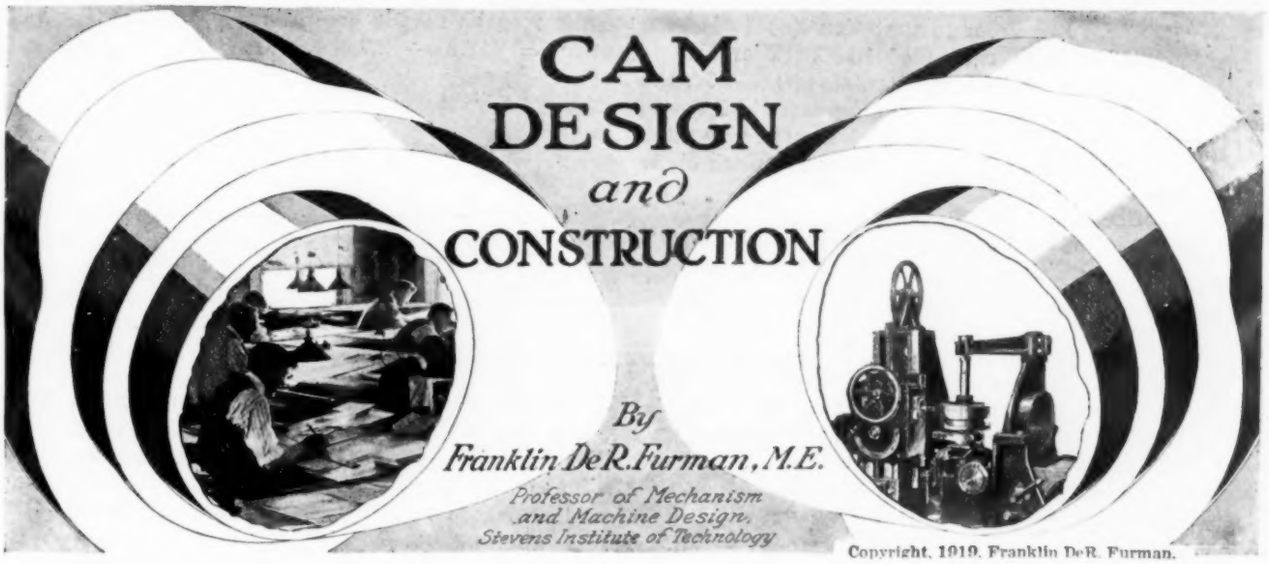
By Arthur H. Morse*

After examining the sketches of "Typical Metal Fittings" on page 712 of the *American Machinist* one is tempted to exclaim *Sutor ne supra crepidam!* or words to that effect, for the artist seems to have misconceived the structure of the parts which he has tried to represent.

In the illustration of the landing gear of the Thomas-Morse scout the label enlightens us as to the presence of a "rubber band." This however could not possibly be of any use because the tube or axle saddle (through which the axle fits after it is assembled) appears to intersect the bent tube which connects the struts and would certainly cut it in two unless all the parts were welded into one. Moreover the slotted bracket, which is intended to act as a guide to the axle saddle when making a landing, is shown with a slot very much less in width than the diameter of the axle saddle, so it could serve no purpose whatever.

But the principal error is in showing the struts with their stream-line sections turned in opposite directions, with their trailing edges toward each other. The sketch of the Thomas-Morse strut socket is also incorrect and misleading.

*Department of Mechanical Engineering, University of Cincinnati.



IV. Various Types of Cams

The current installment deals, first, with multi-step cams in such a way that the greatest pressure angle on the entire cam and the maximum pressure angle on each step may be known in advance; second, the offset cam-roller follower, in which the pressure angle is largest when the follower is at rest and smallest when the follower is in motion on one of its strokes; third, the radial cam, with offset mushroom follower, in which there is a peculiar combination of sliding and rolling action, a special path of action, a minimum size for the mushroom disk and a characteristic pressure angle.

PROBLEM 5. Required a double-step radial cam in which the center of the follower roller moves in a radial line, the maximum pressure angle to be 30 deg. and the follower to move: (a) Up 4 units in $\frac{1}{8}$ revolution on the crank curve; (b) at rest for $\frac{1}{4}$ revolution; (c) up 4 units in $\frac{1}{8}$ revolution on the parabola curve; (d) down 2 units in $\frac{1}{8}$ revolution on the elliptical curve; (e) at rest for $\frac{1}{4}$ revolution; (f) down 6 units in $\frac{1}{4}$ revolution on the parabola curve. In Problem 3 there were only two motion assignments, (a) and (b), in the data, and they were the same except for direction. Consequently only one computation was necessary. When two or more dissimilar assignments are made in the data, as in the present problem, it is advisable to make a computation for the length of the chart diagram for each motion specification as follows:

(a) $4 \times 2.72 \times 8 = 87.04$, which is the length of chart and of the pitch circle circumference = 13.86 pitch circle radius.

(c) $4 \times 3.46 \times 8 = 110.72$, which is the length of chart and pitch circle circumference = 17.62 pitch circle radius.

(d) $2 \times 3.95 \times 8 = 63.20$, which is the length of chart and pitch circle circumference = 10.06 pitch circle radius.

(f) $6 \times 3.46 \times 4 = 83.04$, which is the length of chart and pitch circle circumference = 13.22 pitch circle radius.

The cam factors, 2.72, 3.46 and 3.95 are taken from the Table of Factors, which is here repeated from Article II.

TABLE OF CAM FACTORS

Name of Base Curve	Maximum Pressure Angle and Values of f				
	20°	30°	40°	50°	60°
Straight line	2.75	1.73	1.19	0.84	0.58
Straight-line combination *	3.10	2.27	1.92	1.77	1.73
Crank curve	4.32	2.72	1.87	1.32	0.91
Parabola	5.50	3.46	2.38	1.68	1.15
Elliptical curve †	6.25	3.95	2.75	1.95	1.35

* For case where easing off radius equals follower's motion'
† For case where ratio of horizontal to vertical axes of ellipse is 7 to 4.

Inasmuch as there is a different length of chart and a different pitch line for each item in the data one cannot tell which pitch line to take without some preliminary construction and computation. For this purpose a chart diagram is well adapted as follows: Construct a rectangle, Fig. 39, with a height AT equal to the total motion of the follower in one direction, 8 units in this case. Make the length AA' of rectangle any convenient value entirely independent of any of the

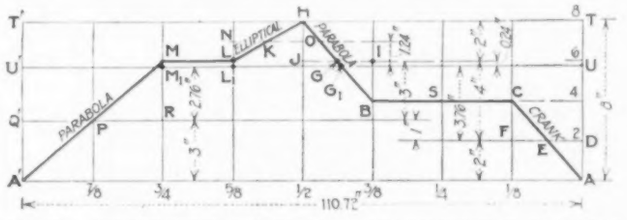


FIG. 39. PROBLEM 5, CAM-CHART DIAGRAM FOR DOUBLE-STEP CAM

values computed above and label this according to the longest chart length as computed above. Lay off straight lines to represent the component parts of the base curve as assigned in the data and label them as shown at AC, CB, BH, etc. Draw the several pitch lines as at FD, JI, etc.

For general procedure consider the pitch line which passes through the point calling for the longest chart length. This will be the pitch line JI passing through G, Fig. 39, which calls for a chart length of 110.72 and a pitch radius of 17.62. If G is to be at a radius of 17.62 in the cam, E will be at a radius of 17.62

— 4 = 13.62. But from computation (a) it is seen that E must be at a radius of 13.86. Therefore if the radius of cam pitch circle is retained at 17.62, the trial pitch line JI on the chart diagram will have to be lowered 13.86 — 13.62 = 0.24, giving the new pitch line UU'. If the line UU' now becomes the pitch circle

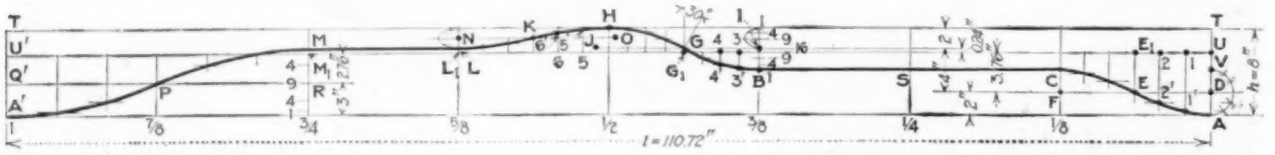


FIG. 40. PROBLEM 5, CAM CHART

the point E will be at 17.62. — 3.76 = 13.86, just as called for in computation (a), and the pressure angle will be 30 deg. at the point E on the cam.

The other critical points at P and K must also be tested with respect to the proposed pitch line UU'. With this pitch line the point P will be 2.76 inside of the pitch circle, or at a radius of 17.62 — 2.76 = 14.86. This is safe, as the computed radius for P was only 13.22 according to item (f). The point K is also safe, for it will be at a radius of 17.62 + 1.24 = 17.86, whereas a radius of only 10.06 is required.

The cam may now be drawn by constructing the true cam chart, as in Fig. 40, which is lettered the same as Fig. 39, and plotting the cam from it, as in Fig. 41. The pitch line UU' of Fig. 40 becomes the pitch

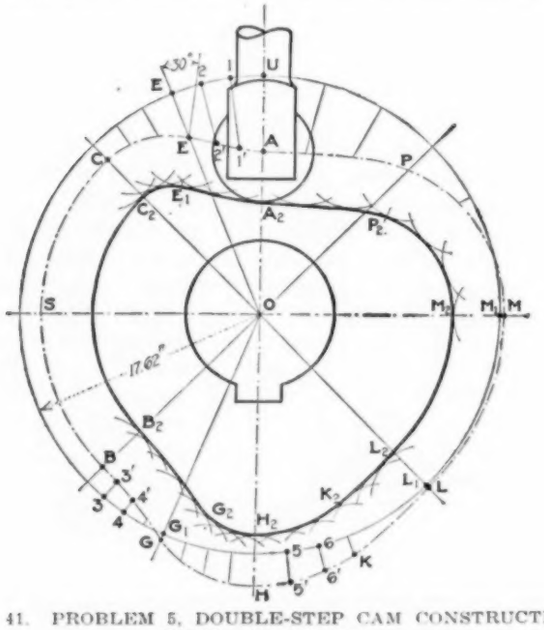


FIG. 41. PROBLEM 5, DOUBLE-STEP CAM CONSTRUCTED FROM CAM CHART

circle, having a radius OU, Fig. 41, and the ordinates of Fig. 40 become the radial measuring lines, Fig. 41; or the cam may be drawn directly, without the use of a cam chart, as indicated in Fig. 42, where the pitch circle OU' is first drawn with a radius of 17.62. The assigned angles are then laid down and the several pitch curves, such as $A'EC$, are constructed at the proper radial distances as determined in Fig. 39 and as illustrated for one case at EE_1 (3.76) in Fig. 42.

Determination of maximum pressure angle for each of the curves making up a multiple-step cam—If it is desired to know the exact pressure angle at P, Fig. 41, it may be readily determined by making the value of r = (17.2 — 2.76) = 14.86 in the formula, $r = 0.159 \frac{hf}{e}$ and solving for f,

$$f = \frac{14.86}{0.159 \times 6 \times 4} = 3.89.$$

Consulting the chart of cam factors in Fig. 21, Article II, it is found that a factor of 3.89, when applied to the parabola chart curve, shows a cam pressure angle of about 27 deg., which is under the assigned limit, and therefore need not be further considered. In a

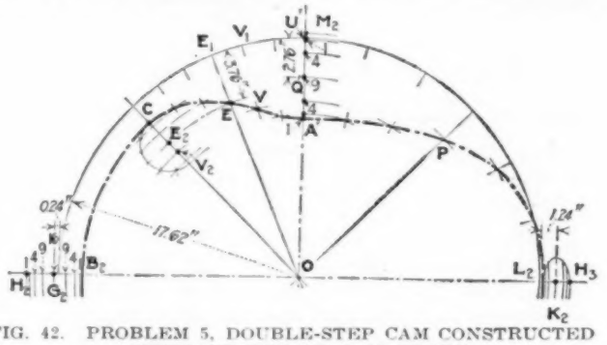


FIG. 42. PROBLEM 5, DOUBLE-STEP CAM CONSTRUCTED WITHOUT USE OF CAM CHART

similar manner the pressure angles at G and K on the cam may be computed, the former being slightly under 30 deg. and the latter less than 20 deg.

CAM WITH OFFSET ROLLER FOLLOWER

Problem 6. Required a single-step radial periphery cam in which the center of the follower roller moves forth and back in a straight line which does not pass through the center of rotation of the cam. The maximum pressure angle when the follower is at the bottom of its stroke is to be 30 deg., and the follower is to move: (a) Up 3 units in 90 deg. on the parabola curve; (b) down 3 units in 90 deg. on the parabola curve; (c) and to remain at rest for 180 deg.

Problems of this nature are totally different, both in pressure-angle action and in methods of construction, from the preceding ones. As may be noted in the data it is required that the pressure angle, when the follower is at rest at the bottom of its stroke, shall be 30 deg. It will appear presently that the pressure angle, when the follower is in motion, may be zero or even negative on one of the strokes in this form of cam. It will also be shown that the maximum pressure angle during the follower motion cannot be assigned in advance and obtained in any practical manner. From the above it follows that the offset radial cam has a peculiar advantage in keeping considerable side pressure off the follower guides during the time that the follower is moving in one direction, although at the bottom of the stroke the pressure angle may have any desired value, and during the period of motion in the opposite direction the pressure angle will reach a maximum value

much larger than the assigned angle at the bottom of the stroke.

The method of construction for the offset roller cam is illustrated in Fig. 43. Simply as a guide the diameter of the pitch circle *UF'ST* may be computed as before by the formula $d = 114.6 \frac{hf}{b}$. It will be found to be 13.22 units as shown at *TY*. An angle equal to the assigned pressure angle is then laid off at *UOU'*, *UO* being parallel to the direction of motion of the follower. Draw a line *DW* parallel to *UO* and so located that it has an intercept *DA* between the pitch circle and the inclined line *OU'*, equal to one-half of the follower motion. This may be done as follows: Lay off *OZ* equal to one-half the travel of the follower. With *Z* as a center and *OU* as a radius draw a short arc intersecting *OU'* at *A*. Draw a vertical line through *A*. The point *A* will then be the lowest point of the stroke, *D* will be the center of the stroke, and *WO* the radius of the "construction circle." The distance *AV* is equal to the assigned 3 units of motion, and the divisions *1, 4, 9* . . . are made according to the requirements of the parabola curve. The assigned 90 deg. is laid off on the construction circle at *WF* and divided into a number of equal arcs at *H, I, J* . . . corresponding to the number of divisions at *AV*, eight being used in the present example. Tangents to the construction circle, such as HH_1, II_1, JJ_1 . . . are then drawn at *H, I, J* . . . and the distances *W1, W4, W9* . . . laid off on these tangents, thus giving the points $H_1I_1J_1$ . . . on the pitch surface of the cam. Or these latter points may be obtained by swinging arcs through *1, 4, 9* . . . about *O* as a center until they meet the respective tangents at H_1, I_1, J_1 . . .

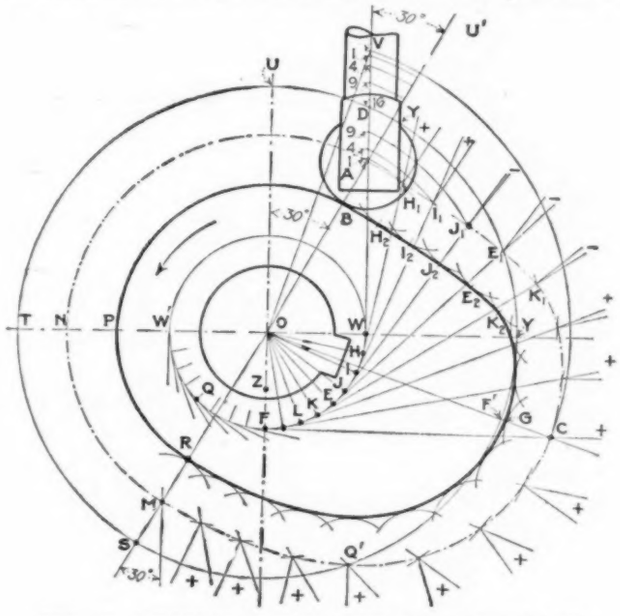


FIG. 43. PROBLEM 6, CAM WITH OFFSET ROLLER FOLLOWER

An examination of the pressure angles for a cam with an offset follower shows that during the up stroke the pressure angles are very small, being, in fact, negative from J_1 to K_1, Fig. 43, and, when measured, the average pressure angle for the working or up stroke is between 6 and 7 deg. in this problem although on the down or return stroke it reaches an average of between 37 and 38 deg. and a maximum of 46 deg. near *Q'*. In this class of problem the computation for diameter of pitch circle serves merely as a guide in determining a size that will give a small cam and a small average pressure angle on the working stroke. If the diameter of the pitch circle is arbitrarily taken either larger or smaller than the value, as above computed, or if other base curves are used, the negative pressure angles at J_1, E_1, and K_1 may disappear entirely, which would be an advantage where it is desired to have pressure on the follower guides on one side only.

It has doubtless been observed that there is a decided lack of symmetry in this form of cam even though the data are similar for both strokes of the follower. This is illustrated in Fig. 43, where the portion *AC* of the pitch surface for the outstroke is quite different from the portion *CM*. It is also characteristic of this form of cam that the pitch and working curves each embrace either a smaller or a larger angle than the assigned angle for a given stroke of the follower, as shown by the angle *AOC* being less, and the angle *COM* being greater, than the assigned 90 deg. This of course is due to the fact that when *C* has traveled 90 deg. to *V* the line *OC* will have passed the original zero line *OA* of the pitch curve and will be in the position *OV*. Therefore the cam angle for one stroke of the follower will be less than the assigned angle by the amount of the angle included by *VOA;* for the other stroke it will be greater than the assigned angle by the same amount.

Radial Cam With Offset Mushroom Follower Disk

Problem 7. Required a radial periphery cam to operate an offset follower which has a flat circular disk surface instead of a roller. The follower to move: (a) up 3 units in 90 deg. on the parabola base; (b) down 3 units in 90 deg. on the parabola base; (c) at rest for 180 deg. Followers of this type may be offset without any change in the general method of construction. In this problem the follower will be offset as shown in the side and top views in Fig. 44, where the center line *N"Y"* of the follower spindle is set the distance *P"O"* in front of the center of the cam plate. In this case there will be a part sliding and part rolling of the cam on the follower and the follower will turn about its own axis N"Y" as it is being raised and lowered. When the follower is not offset, i.e., when the center line *O"N"* is placed in line with *M"P"*, the action will be all sliding and there will be no turning of the follower spindle on its axis. In this case there will be localized wear on the follower, while in the former case the wear will be more widely distributed over the follower surface. In both cases the construction is the same and is explained in the following paragraph.

In cam followers having flat surfaces perpendicular to the line of action the line of pressure is *M"Q"* and is parallel to the line of action of the follower instead of being inclined to it as in the case of cams having roller followers. Because of this characteristic action the ordinary pressure-angle factors do not apply in cams of this class in computing or obtaining the diameter of the pitch circle *DFST*, and this circle may be assumed. In some cases a fair guide for the size of this circle may be obtained by using the regular formula $d = 114.6 \frac{hf}{b}$ for diameter of pitch circle, assuming the

30 deg. pressure-angle factor. Solving, r is found to equal 6.61, and is laid off at O D. The assigned three units of motion are then laid off, one-half on each side of D, as at A and V. The assigned 90 deg. are next laid off at AOF and divided into the desired number of construction parts, four being used in this case, as at OD_1, OD_2. . . . The distance AV is also divided into four parts, AH and VK being each equal to 1 unit and HD and KD equal to 3 units. Only four divisions are taken in this case to avoid confusion of lines in the illustration, but in student problems 6 or 8 points should be taken, and in practical work 12 to 24 divisions should be used. The first division point H is now revolved to meet the first radial division line OD_1, thus giving the point H_1, where a line H_1E is drawn perpendicular to H_1O. This line H_1E represents the bottom of the follower disk AC with reference to the cam when the cam has turned through the angle AOH_1. The points D_2 and K_1 are obtained in the same manner as was H_1 and corresponding perpendiculars are drawn, as at D_2D_4 and K_1K_2. As smooth a curve as possible is now drawn tangent to these perpendiculars and the points of tangency marked as at H_2, D_4 and K_2. This smooth curve AG is the working surface of the cam.

The size of the follower must also be determined. The most satisfactory way of doing this is to find the locus, or path, of the line of contact between the periphery of the cam and the follower disk. This is obtained by considering that when H_1 is at H the point of tangency H_2 is at H_2, the length HH_2 being equal to H_1H_2. Likewise when D_3 is at D, D_4 is at D_2, and the same for the other points of tangency. The dash-line curve through the points $AH_2D_2K_2$ . . . is the locus of contact between the cam and the follower. The point L is the extreme point of this curve, and if the follower were not offset, the length of an ordinary toe or flat extension of the follower would have to be at least equal to $N'X'$. If the follower is offset, say by the amount $N'M'$ $(= N''M'')$, the radius of the disk will have to be at least equal to N' L', and the extreme line of contact will be $L'J'$. The other extreme line of contact will be a similar line through L''', and the area of the flat disk which will be subject to wear will be the annular surface between the periphery and the dash-line circle whose radius is $N'A'$. As to the wear on the cam itself there would be pure sliding of the curved surface AG on the flat surface AX if the follower were not offset. With an offset follower there is an effective turning radius equal to the offset $N'M'$ tending to rotate the follower about its axis $N''Y''$, and this changes the action of the cam on the follower entirely by causing part rolling and part sliding.

The presure angle in this form of cam must be considered differently from cams which operate against rollers. In roller-follower cams it is the angle between the normal to the cam pitch surface and the line of action of the follower that determines the side pressure on the bearings, whereas in flat surface followers it is the distance that the line of contact is away from the line of action that determines it. This distance varies constantly, and in the illustration in Fig. 44 the limits of variation are $M'N'$ and $Q'N'$. These are in reality lever arms on which the pressure acts to produce a turning moment, which must be resisted by the follower guides. Since there can be no pure rolling action between the cam and the follower in constructions of this type there is nothing to be gained in this particular by a large offset. On the contrary, there is much to be lost due to the large bending moment that would be set up in the follower rod. A fair guide as to the offset would be to keep the angle formed by the center line $Y''O''$ of the follower motion and the line $Y''M''$ or $Y''Q''$ joining the center of the bearing with the midpoint of the line of contact to within say 30 deg. or any other maximum value that circumstance might warrant. The angle here defined might be termed the pressure angle in this type of cam. The minimum pressure angle $N''Y''M''$ is seen in its true size. The pressure angle at the top of the stroke is shown at $U''Y''Q''$.

Limited use of cams with flat surface followers—Cams with followers of this type are not well adapted in

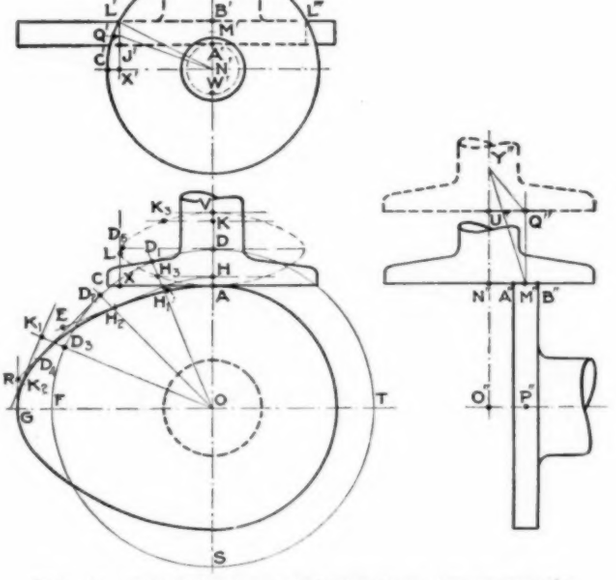


FIG. 44. PROBLEM 7, CAM WITH FLAT SURFACE FOLLOWER—MUSHROOM CAM

general for cases in which the follower must have specified velocities during its stroke. If the follower is required only to move from one end of its stroke to the other in a given period of time, independently of all intermediate velocities, this form of construction may be readily applied. The principal difficulties to be met in the building of these cams when the intermediate velocities are specified, are, first, the large time angles necessary for a desired follower motion, or, second, a comparatively large cam. The cause of these difficulties may be pointed out in Fig. 44, where it may be seen that the construction point K_1 might have been so much further out radially that the perpendicular line K_1K_2 would have passed to the left of R and it would have been impossible to draw the smooth cam curve AG tangent successively to *all* the perpendiculars. The limiting practical case appears when any three successive construction lines meet in a point, in which event the cam will have a sharp edge and be subject to excessive wear at that point. This subject is further considered in a later article.

If one is not limited in the time, or angle, in which

the follower must do its work, or if not limited in the size of the cam, this form of construction may be used for any set of velocity values so long as they produce a working surface which always curves outward or which has an edge which points outward.

Controlling a Shop System

By W. T. Edwards

On page 34 is an article by John H. Van Deventer, which deserves to be studied carefully by all shop owners and managers, for it deals with conditions that they have no adequate knowledge of.

Even Mr. Van Deventer writes as one having no inner knowledge of what an elaborate and entirely uncontrolled system may become; for he suggests as a remedy that workmen be paid for telling about the bad points in the system. In this he ignores the fact that not only are workmen not encouraged to report the faults in a system or suggest improvements, but are actually punished for doing so.

Of course punishment for this reason is not provided for in the written or above-board side of the system, but is inflicted by the systematizers; probably in unconscious obedience to the instinct for self-preservation that all must feel and follow if left free to do so. The punishment varies from discriminations against the offenders and preferences given to fellow workmen who are more "discreet," up to being discharged and secretly discountenanced to other firms in the same line of work. The precise cause for dismissal would not read well on the records but other reasons may easily be given; for all workmen (like shop owners and managers) have many faults, and by dint of recording these and none of the good qualities, a bad case may be made against anyone.

If the offender has influence with the firm or has no faults worth mentioning, it is quite easy to make an "improvement" whereby his work is done in another department, or by another process and a much less important position offered him. More commonly his job is split into several small jobs that may each be done by a man receiving a smaller wage than himself though their aggregate wage is much larger. If any of the above plans are impracticable he may be "promoted" to a job that he is utterly unfitted for, where he is likely to give indisputable proof that the firm would be better off without him. Precisely when he is discharged, or leaves of his own accord, is then only a matter of time.

So the system not only gets rid of a thorn in its side but it also receives commendation for the infallible way in which it picks out an "inefficient" man. The system must win whether it works for or against a firm, not because of some mysterious power in a system but because its perfection is taken for granted by those who should be its judges, but who really are its advocates. Any one person or institution that is sincerely trusted will also be right in all they do; for the shop owners' and managers' mental attitude is usually that of the little girl who said: "What my mother says is so, whether it is so or not."

Should the culprit's offense be so slight that it is punished only by the disapproval of the persons who comprise a shop system it is quite sufficient to teach him that the "loyalty" so loudly preached to him means loyalty to the system and not to the firm when the interests of the two are not identical. So he either conforms to the system and silences his conscience, or he obtains employment elsewhere and again elsewhere, in the hope of finding a firm that will not punish him for working in their interest but will allow him to earn his wages without searing his conscience. What his thoughts are when he reads the advice of experts on how to reduce the labor turnover may be imagined.

Now the prevention of this enormous loss is not in merely offering rewards for reporting defects in a system; for the system will "get" those who do so, unless provision is made to prevent it. It could be accomplished by a plan that has been tried in Europe and approved by workmen and foremen. The plan is to post a notice in the shop instructing the workmen to carry all complaints and ideas for improvements to the foreman immediately above him, as is usual at present in this country. But should he fail to obtain satisfaction the notice directs him to whom to go next, giving him the right to appeal until he reaches the highest authority; always providing that he has previously appealed to all those of lesser authority mentioned. This will not throw much extra work on those higher up, for the minor officials (causes of almost all labor troubles) knowing that their decision is subject to revision will take care to decide fairly and wisely and this will nip almost all trouble in the bud. Should a case reach the highest authority (who should be one who is financially interested in the firm's success) through sheer persistency of the workmen, an example could be made of him that will teach others to have a case that can be proven before they make complaint. If a brief summary is posted of the facts regarding the cases decided against the workmen, they would have a helpful effect and aid materially in preventing charges of unfairness.

Chart for Finding Volume of Metal Removed or Area Machined in Turning or Grinding*

By R. Poliakoff

Assistant Professor of Mechanical Technology, Technical Institute, Moscow, Russia.

In the description of the chart for finding the volume of metal removed or area machined which follows, reference is made to machining operations only. It should be noted that all that is said refers to grinding operations as well.

The divisions on the left side of the column above the division marked *1* represent the speed in feet per minute and also the *inverted* feed in inches per revolution. For instance, the division marked 100 represents a speed of 100 ft. per minute or a feed of $\frac{1}{100}$ in. The divisions on the left side of the column below *1* represent depth of cut in inches. The divisions on the right side of the column represent either volume of metal removed in cubic inches per minute or area machined in square inches per minute.

How to Use the Chart

a. *To find volume of metal removed*, take (with calipers) the distance between the depth of cut in inches, as shown on the left side of the column below *1* and the inverted feed shown on the same side of the column above *1*. Set off this distance above the division *1* on the left column.

Let division x represent this set-off distance. Select on the left side of the column the number correspond-

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ing to the speed expressed in feet per minute. Take the distance between this number and the division x and set it off from *1* upward, if the number representing the speed is above x, and downward if it is below x. The number on the right column opposite the end of the set-off distance will represent the volume of metal removed expressed in cubic inches per minute.

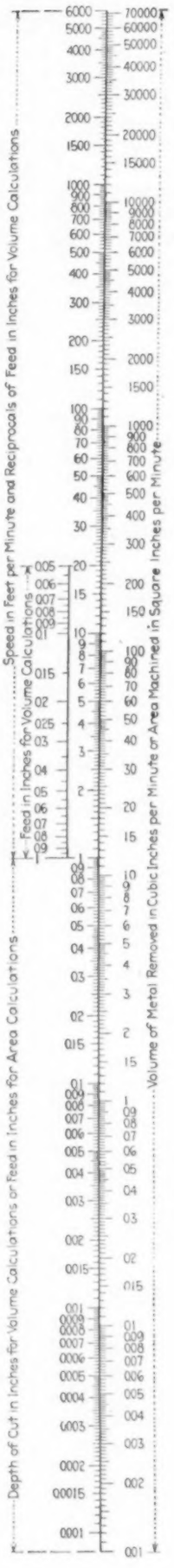
b. *To find the area machined*, the speed in feet per minute is to be read on the left column from *1* upward, the feed in inches on the same column from *1* downward. In order to find the area machined in square inches per minute proceed as follows: From the number representing the speed in feet per minute on the left column set off the distance corresponding to the feed in inches taken, from *1* downward. The number on the right column corresponding to the end of this set off distance will represent the area.

Example 1.—Speed $V = 100$ ft. per minute; depth of cut $= \frac{1}{4}$ in. $=$ 0.25 in., feed $= \frac{1}{16}$ in.; to find volume removed.

Take distance between division 21 (inverted feed) above *1* and division 0.25 in. (depth of cut) below *1* on the left column and set it off from *1* upward. Take the distance between the point obtained and the number 100 (speed) on the left column and set it off from the division *1* of the left column upward; the end of the distance so set off coincides with 14.3 on the right column, which is the number of cubic inches removed per minute.

Example 2.—$V = 40$ ft., depth of cut $= \frac{5}{16}$ in. $=$ 0.31 in., feed $= \frac{1}{25}$ in.; to find volume removed. In this case the end point of the distance between 0.31 in. (below *1*) and 25 (inverted feed above *1*) set off from *1* upward will fall above division 40; therefore the distance between 40 and this point has to be set off from *1* on the left column downward. The number on the right column opposite the point so received will be 6.

Example 3.—$V = 4000$ ft., depth $=$ 0.01 in., feed $= \frac{1}{12}$ in.; to find volume removed. In this case the distance between 0.01 (below *1*, left column) and 12 (inverted feed, above *1*) is smaller than the distance between *1* (left column) and 4000 (speed number) and the distance between 4000 and the sum of 12 and 0.01 set off above *1* has to be set off from *1* upward and will give the number 40 on the right column.


Speed in Feet per Minute and Reciprocals of Feed in Inches for Volume Calculations
Feed in Inches for Volume Calculations
Depth of Cut in Inches for Volume Calculations or Feed in Inches for Area Calculations
Volume of Metal Removed in Cubic Inches per Minute or Area Machined in Square Inches per Minute

Example 4.—$V = 120$ ft., feed $= \frac{1}{30}$ in. $=$ 0.033 in.; to find area machined. Take number 120 on the left column; set off from it downward the distance between *1* (left column) and division 0.033 (left column below *1*. One will read on the right column 48, which is the number of square inches of area machined per minute.

Example 5.—$V = 30$ ft., feed $= \frac{1}{50}$ in. $=$ 0.02 in.; to find area machined. Take number 30 on the left column; set off from it downward the distance between *1* (left column) and division 0.02 (left column below *1*). One will read on the right column 7.2, which is the number of square inches of area machined per minute.

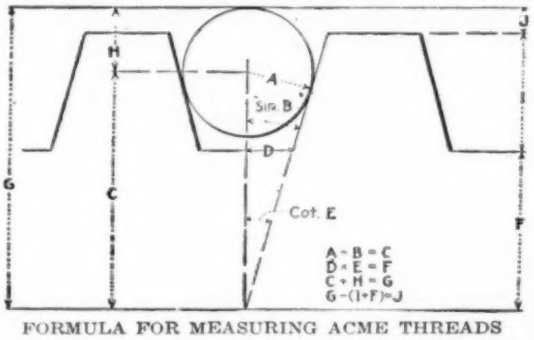
Example 6.—$V = 4800$ ft., feed $= \frac{1}{4}$ in. $=$ 0.25 in.; to find area machined. A similar procedure gives 14,400 sq.in. per minute as the area machined.

It will be noticed that a short piece of the chart with divisions marked from 1 to 0.05 in. $= \frac{1}{20}$ in. is shown a little to the left of the main chart. This is really the part of the main chart corresponding to feeds from 1 to $\frac{1}{30}$ in., which feeds are shown on the left column of the main chart by inverted numbers. But in order to be able to read feeds down to $\frac{1}{50}$ in. (such as 0.95 in., 0.90 in. . . . 0.065 in., 0.06 in., 0.055 in.) more accurately, this part of the left column of the main chart has been brought out separately.

Measuring Acme Threads Without Special Wires

By Herbert H. Miller

Lately I have come in contact with a good many men who seem to have trouble in measuring Acme threads on account of not being able to get certain size wire called for in the books. The only formula they can find



FORMULA FOR MEASURING ACME THREADS

is the one which figures a wire that would extend 0.01 in. over the top of the screw and come flush with the top of the tap. This prompted me to make the formula here shown which is of value especially in female gage work, since you cannot get balls of special size very easily.

Example for 8 pitch:

B	A	C
0.25038	0.312500000	0.12481
	25038	
	62120	
	50076	
	120440	
	100152	
	202880	
	200304	
	25760	

3.8667 = E
0.02055 = D
193335
193335
77334
0.079460685 = F

0.07250 = I
0.07946 = F
0.15196

0.12481 = C
0.03125 = H
0.15606 = G
0.15196
0.00410 = J

Industrial Democracy*

BY DR. CHARLES A. EATON

According to Doctor Eaton, democracy is not a set form; it is an underlying principle. If it is a good principle upon which to base our political government, it is a good principle upon which to order our entire lives. Democracy as a principle of government is considered the best that has been so far conceived; then why not extend this principle as a foundation for our social and industrial institutions?

IN THESE dark and difficult days when the whole world, spent with the exhaustion of unbelievable struggle, is groping blindly after peace, there seems to be practical unanimity upon one fundamental fact. Democracy is to be the organizing principle upon which and by means of which the new age is to be builded.

Since men began to live together in ordered societies, they have been haunted by this ideal. But never before has the world consciously accepted democracy as the only possible scheme of life.

The modern Athenian is today being forced to make practical application of principles which Aristotle set forth as theories in his politics millenniums ago. The myriad peoples of the dreamy East are as eager as the most practical of Occidentals in their quest for full and free democracy. Even Germany, with awkward reluctance, is changing the medieval armor of her beloved autocracy for a brand new suit of Anglo-Saxon working clothes.

Government of the people, by the people, for the people has long been the possession and pride of English-speaking races. Problems of political democracy have constituted the staple of our history. Under our system, developed for the most part by orderly evolution, government exists by consent of the governed. We have developed a government of laws rather than of men. Representation in its law-making body is the divine right of our citizenship. Public opinion created and informed by free discussion is the last court of appeal. The majority rules. The minority is protected in its rights by law impartially administered through the courts, which are simply a projection of the public conscience and intelligence. By peaceful agitation and education, the minority is always free to swing public opinion to its view, and thus raise itself to political power.

DEMOCRACY NOT ONLY A POLITICAL IDEAL

Before the war, we in America thought of democracy as a political ideal. We were interested in political rights and liberties and duties and dangers. We had lost sight of the very simple but important fact that a great primary principle always tends to assert its authority over the whole of life. All life is one. A man cannot keep his religion and his politics and his work separated from each other in water-tight compartments of his nature. He cannot be a democrat in politics and an autocrat in business. It is impossible to build one building upon two foundations. Lincoln was right when he argued that the nation could not exist permanently half slave and half free. If slavery were right as an organizing principle of society, then freedom would ultimately be swallowed up. If freedom were the true and right principle, then slavery was doomed.

Science has taught us that the world is governed by one universal law; that all progress is measured by one universal standard; and that all life is organized upon one universal principle. Religion declares that there is one God, who has created all men of one blood to dwell together in one world. Philosophy seeks ever for one supreme central idea, capable of organizing, coördinating and sustaining the entire life of man, individual, social, material and spiritual.

It is therefore strictly in accord with the nature of things that democracy should seek at this time to enthrone itself in all human relations and institutions. If the war was fought to "make the world safe for democracy," then the succeeding period of peace will be spent in trying to make democracy safe for the world. Democracy is not safe for the world if it can be applied to only one portion of our complex life. Nor will it be safe for the world, if when applied to the whole of life, it reveals itself as a mere social makeshift, rather than a universal principle.

THE BIG ISSUE OF THE HOUR

The American people must face the issue squarely. We are, and always have been, a political democracy. We entered the world war because we believed that our democratic system of liberties and rights were endangered by German autocracy. Democracy won the war. Will it be able to organize the peace?

It is a singular fact that we are confused, disturbed, and even alarmed, by the sudden necessity, which everyone feels, of attempting to apply the principle of political democracy, in which we all profess to believe, to the whole organized life of the nation. Before the war there was a long period of strife between labor and capital. On the surface, this struggle seemed to be a matter of dollars. We now see that this view was as superficial as it was dangerous to the well-being of the country.

What this industrial unrest and strife really indicated was that the principles of democracy were trying to get themselves applied in the realm of industry, as they had succeeded in getting themselves applied in the realm of politics. And this is now the big issue of the hour for the American people. Can the thing be done? Is the essential nature of industry such that it must be carried on under a system of autocracy? Or can industry be democratized?

We must approach the problem with open minds. It will not do to jump at conclusions; still less to become panic-stricken or stampeded into trying any half-baked, unpractical, Utopian cure-alls. There are several things which I am sure Americans will not do.

We will not lie down, nor lose our nerve, nor hide our heads after the manner of the ostrich. Nor will we accept the Bolshevist substitute for democracy. There will be no proletarian dictatorship in America. The Russian idea may do for Russians; that is for the Russians to decide. But common sense, hard-headed American ideas are good enough for us.

In a letter to the American workingmen, Mr. Lenine, who, having turned Russia into an industrial and political millennium, is now impelled by a heaven-born altruism to grant the manifold blessings of Bolshevism to more benighted countries says, "The Workmen's and Peasant's Soviets are a new type of state, a new highest form of democracy, a practical form of the dictatorship of the proletariat, a mode of conducting the business of the state without the bourgeoisie, and against the bourgeoisie. For the first time, democracy is placed at the service of the masses of the workers, and ceases to be a democracy for the rich, as it is in the last analysis, in all capitalist, yes, in all democratic republics. For the first time, the masses of the people in a nation of hundreds of millions are fulfilling the task of realizing the dictatorship of the proletariat and the semi-proletariat, without which socialism is not to be thought of."

This paragraph is the kind of stuff that throws our parlor Bolshevists into vociferous rapture; but the ordinary American finds it hard to pronounce the words proletariat and bourgeoisie and is not usually in favor of burning down his house in order to roast his pig. Besides, he knows that it has cost centuries of struggle to reach his present condition of economic superiority over the working-

* An address before the Industrial Conference of the New York Business Publishers' Association, April 11, 1919.

men of any other country in the world, and he prefers to go on building step by step upon what he has already achieved rather than try to turn his country into chaos in the hope that, like a grave-robbing ghoul, he may find some imaginary treasure among the ruins.

A majority of the American people will always find in the following noble words of Theodore Roosevelt full and fair expression of their conception of citizenship: "In the unending strife for civic betterment small is the use of those people who mean well but who mean well feebly. The man who counts is the man who is decent and who makes himself felt as a force for decency, for cleanliness, and for civic righteousness. He must have several qualities: first and foremost, of course, he must be honest, he must have the root of right thinking in him. That is not enough. In the next place he must have courage; the timid man counts but little in the rough work of trying to do well the world's business. And, finally, in addition to being honest and brave, he must have common sense. If he does not have it, no matter what other qualities he may have, he will find himself at the mercy of those who, without possessing his desire to do right, know only too well how to make the wrong effective."

One of the extraordinary changes wrought by the war is a new attitude toward industrial questions, not only in our own country, but throughout the civilized world. Every forward-looking man realizes that the first task for all free peoples is to reorganize and rebuild industry upon the principles of political democracy.

The task is difficult, but by no means impossible. If it ought to be done, it can be done. There is a marked willingness on the part of employers to consider plans and methods by which autocracy may be eliminated from their relations with their employees, and genuine democracy substituted therefor. The real American leaders in our labor organizations stand ready to meet employers in a spirit of genuine coöperation in making the experiment.

Before we can achieve an orderly, permanent and workable application of democratic principles to industry, we must come to some agreement as to what democracy is; what are its limitations; and what are the duties, rights, sanctions and principles which are bound up in its adoption

True Democracy Recognizes No Class

True democracy takes no cognizance of classes. It will have nothing to do with class interests as such. It demands equality before the law for every citizen as an individual, and not as a member of a class. It has room in it for all types and sizes of men, guaranteeing to each opportunity to realize his full possibilities of development, achievement and service.

The glory of American democracy has lain in its power to encourage and reward individual initiative. Every boy, in theory, under our system may achieve success. A rich man has one vote; a poor man has one vote. Each alike is guaranteed by our constitution the natural right to life, liberty and pursuit of happiness. Freedom and justice are the twin foundations of American democracy. The right to acquire and hold private property is the very keystone of our social system.

The normal American is more convinced than ever, after the painful experiences of the war period, that the less government we have the better off we are. The best government is self-government. Our theory is that government ought to do nothing for a man or group of men that they can do for themselves. Government is representative of all the people. The majority rules by the sanction of public opinion. The law is simply the practical projection of the public conscience.

Before we can get our industrial system reorganized and running smoothly, it will be necessary for all parties to reach an agreement as to what work and wealth really mean. If there is a natural and therefore necessary antagonism between labor and capital, as the Socialists and Bolshevists teach, it is folly to dream of industrial peace. Capital and labor are doomed by their very nature to seek each other's destruction. If capital is destroyed, labor will fall back automatically to the Stone Age, and the race will begin all over again its slow and painful journey toward civilization. If labor is destroyed the world will starve, for no one can eat money or machinery.

It is plain, therefore, that both capital and labor need to be educated in the school of coöperation. Personal contact must take the place of corporate autocracy. We must have human beings in the director's room and manager's chair, and they must be of the same brand of humanity as the men in the works.

The principles of representation in industry, if properly applied, will make a new era in industrial relations. This idea has been practiced in England and elsewhere for some years, and it is now being taken up by some of our industrial organizations in this country. It rests upon an analysis of the practice of industry into four parts, capital, management, labor and the community. By a system of representation, beginning at the bottom among the men and working up until it includes men, management and capital in the entire industry, it has been found that friendly coöperation becomes easy. Grievances disappear, difficulties are smoothed away and the whole enterprise takes on a new spirit.

The restlessness of labor is only a reflex of the unsettled psychological conditions at present obtaining throughout the whole world. But there are causes peculiar to industry which account for a part of the labor disturbances. The workingman, who is simply one cog in a vast impersonal machine, is irritated unconsciously by the fact that he has ceased to be a man with creative instincts, and has become a machine. The cure for this fundamental disturbance is to make the man a part of the whole enterprise. I hold that we shall never have complete coöperation and partnership between the various parties in interest until each worker receives a thorough instruction in the meaning, origin, purpose, development, difficulties, and successes of the business in which he is employed. When thus his intelligence and imagination have become awakened, his individual task ceases to be a mere mechanical motion, without relation and without beginning or end, and becomes his contribution to the great sum total of the enterprise. He is no longer working for an employer, but is working for the entire organization. If he is working for any one, it is the community, and under this system of education and representation, the man works for the community as a national service in return for protection, voted by the organized law of the community.

This new system of representation does not mean that the workers are to manage the business any more than it means that the shareholders shall manage the business. Management remains a factor by itself, the only difference being that whereas management had as its task the direction of men with personal relationship to the management, now it directs and coöperates with these men as partners in the business. The management no longer represents only capital. It now represents labor as well. Labor no longer represents only itself, but now represents the community and, in a certain sense, both capital and management.

Already Past Experimental Stage

Industrial democracy has already passed the experimental stage in America. The Colorado Fuel and Iron Co., the Standard Oil Co., the International Harvester Co., the Bethlehem Steel Co., the United States Steel Co. and the Eastman Kodak Co. are among the great organizations which have adopted this principle. Generally it has been found to work well. Representation in industry does not introduce the millennium or change the qualities of human nature. It does, however, bring the four parties of industry into knowledge of each other, and out of this knowledge creates a spirit of friendship, confidence and coöperation.

Labor throughout the English-speaking world has formulated its demands on many occasions, and in language easy to understand. The sum total of labor's demands amounts to this: The workingman desires to become a human being; to have proper physical conditions surrounding his labor; to secure a sufficient return to give his family the right kind of a home and to equip him to realize his manhood and discharge his duties as a citizen.

After a wide and varied first-hand acquaintance with workingmen, their leaders and their systems of organiza-

tion in this country, I have reached the conclusion that it is possible for the leaders in American industry, representing management and capital, to meet the old line organizations half way and to effect a system of mutal good will and coöperation by means of representative organization. If this is done we shall have raised an impregnable bulwark against the floods of Bolshevism, anarchy and stupid destructive theorists which threaten to destroy the world. We must get together. We must affect this reunion by discarding our antagonisms, our prejudices and our fears. If we cannot trust each other it is useless to attempt to build any permanent institutions upon distrust.

We must educate the public as well as labor in the difficulties, limitations, and laws which govern the operations of capital. We must learn to understand the aspirations, weaknesses and tremendous possibilities of labor as a social force. We must see to it that all parties get a square deal. Capital is entitled to a fair return; labor the same; and labor must lift restrictions from output in order to receive a larger share of the country's wealth.

In spite of the uncertainties and strangeness of the new conditions created by the war, I am convinced that America is entering upon a new industrial era which will mark a great advance upon the chaotic, short-sighted methods of the past. There will be a period of experiment, with the usual failures and successes. But we shall soon learn to work the institutions of democracy in the realm of industry with greater efficiency than we have ever known in politics.

Some of Our Post-War Problems*

By FRANCIS B. SISSON
Vice President, Guaranty Trust Co.

It is not always the debtor who occupies the anxious seat; there are times when it is exceedingly uncomfortable and inconvenient to be the creditor. Some of the problems connected with untangling the financial conditions resulting from the war are ably considered by the speaker.

DESPITE the heavy financial burdens imposed by the war, America is confronted with an embarrassment of riches—at least so far as indebtedness to this country is concerned. And thoughtful business men throughout the country are beginning to realize that our position as the greatest creditor nation of the world has its serious disadvantages and responsibilities. We gradually are comprehending, also, that whether or not there shall be a formal organization of a League of Nations, we are bound to other peoples by innumerable and far stronger ties than those which any international covenant could impose.

There has, indeed, been no more convincing proof of this fact than that recently provided by the "unpegging" of, or withdrawing of governmental support from, sterling and franc exchange. The larger significance of what was seemingly only a financial operation is daily becoming more apparent. It marks in a dramatic fashion the shifting from a war to a peace basis, not alone in financing but also in practically every economic phase of international relations. It is one of the most immediate, vital post-war financial problems, and concerns the importer and manufacturer of domestically consumed products as well as the exporter and manufacturer of goods which are sent abroad—for it creates an invisible tariff against American goods in England and France which, sooner or later, but inevitably, will affect our domestic trade. We are awakening to a realization that the prosperity of the country today depends upon increased production and, consequently, that it behooves us to expand our foreign markets, instead of letting them contract.

Our Recent Trade Balance

It is true that during January and February of this year, the value of our exports has exceeded the value of our imports in record-breaking amounts. The statistics recently issued by the Department of Commerce show that our exports during January exceeded those of any other month in the history of the country, aggregating in value approximately $623,000,000, which was $57,000,000 more than in December, and $118,000,000 in excess of January, 1918. In February of this year our exports were valued at $588,600,000.

These are decidedly encouraging figures, but we must not be misled by a superficial consideration of their significance, and forget what such unprecedented purchasing abroad of our products entails. We cannot continue to ship such enormous quantities of goods overseas unless the buyers pay us for them. There are three ways in which they can settle their bills, namely, by means of goods or service, by gold, or by securities or other instruments of value.

If we are to increase our production, which, as I have pointed out, is necessary to the maintenance of our prosperity, we cannot take goods in full exchange for our products. Besides, we are nearer than any other people to economic independence, and do not need imports in anything like the quantities necessary to settle the trade balance in our favor.

We Do Not Want More Gold

Payment in gold is as impossible as it undesirable. The value of the excess of our exports over our imports in January alone exceeded the total value of gold produced in all countries, except the United States, during 1918. In addition, we now hold more than one-third of the world's reserve of gold coin and bullion, having added about $1,500,000,000 to our store of the precious metal in the last four years. We could not with safety drain other nations of their remaining low stock of gold, if we would, for as we are already their creditors to the extent of about $12,000,000,000, it is imperative for us to help them maintain their currency on as sound a foundation as is practicable under existing circumstances.

The granting of credits to purchasers of our goods will very materially aid in solving the immediate problem of financing foreign trade, but, at best, it can be only a temporary expedient. Credit, as you are well aware, is merely the giving of a present value in exchange for a promise to pay. It serves to postpone payment of indebtedness to a more propitious time for the buyer or borrower, but it does not settle the account.

This expedient was necessarily resorted to on a colossal scale during the war, and England was able to weather so successfully the financial storm during the early stages of the conflict and to lend large sums of money to her less fortunate allies because she had extensive credits and investments scattered all over the world.

England's Invisible Exports

Before the war England had "invisible exports" amounting to approximately $1,800,000,000 a year, consisting chiefly of interest in foreign investments which totaled about $1,000,000,000. The toll from foreign freight carried in English ships netted her something like $800,000,000. So that while England apparently had an adverse trade balance in 1913 of $670,000,000, in reality she had a favorable balance to the extent of more than $1,100,000,000.

On the other hand, our favorable trade balance of $500,000,000 prior to the war was about equalized by our payment of interest and dividends abroad, freight rates, etc.

Then war came, and Europe, plunged into the most destructive of conflicts, needed in vast quantities the products

* An address before the Industrial Conference of the New York Business Publishers' Association, April 11, 1919.

of our fields, factories and mines. American securities held abroad were sold back to us in wholesale quantities, in order that munitions and supplies might be purchased with the proceeds; more than $2,000,000,000 were lent to foreign governments through private channels in this country, and subsequently, foreign governments floated large loans in our markets.

When we entered the war, the financing of our Allies was naturally taken over by the Government, which advanced credits to them to the extent of more than $9,000,000,000. There remains less than $1,000,000,000 of the fund appropriated by Congress for the purpose to be lent to our Allies.

And it is to meet the situation created by this circumstance that the Government is arranging to aid American exports trade by advancing $1,000,000,000 through the War Finance Corporation. Without entering into consideration of the merits of this plan, it will readily be seen that it consists merely of the granting of credits for purchases here and, therefore, can only be in the nature of an expedient, even though the credits extend over a period of five years. Furthermore, if the value of our exports continues to exceed the value of our imports at the present ratio, even $1,000,000,000 can not be effective as a remedy.

While there has been no official statement issued by the British or French governments as to the reasons for withdrawing their support from sterling and franc exchange, respectively, one result is inevitable, namely, the curtailment of the purchase of American goods in France and England. This is probably one of the two principal reasons for the so-called "unpegging" of these exchanges. The other reason was doubtless the high cost of supporting pounds and francs at the figures at which they had been held prior to the withdrawing of Government support.

The Invisible Tariff

Both England and France realize the danger of piling up huge indebtedness for our products on top of the pyramid of such obligations already existing. They are well aware that by permitting exchange to take its natural course, the American dollar must inevitably be at a premium, which means, of course, that less can be purchased in France and England by the dollar than heretofore, and, consequently, buying of American goods will be discouraged. As I have remarked, an "invisible tariff" is thus created against our products. We cannot criticise England or France for taking this protective measure, particularly when we consider that the support of sterling exchange necessitated the purchase by British agents of between $3,000,000,000 and $4,000,000,000 worth of sterling in the American market during the period in which exchange was controlled by the British treasury.

As one English authority recently explained, England "had been bearing the burden of maintaining the relation of sterling to the dollar not only up to the day when the United States came into the war, but ever since. It has been very costly borrowing dollars daily or weekly at 5½ per cent. in New York to pay for all the sterling bills offered in London at $4.76 per pound.

The Solution

"A point often arises in the relation of debtor and creditor when it is the creditor, and not the debtor, who is on the anxious seat," this same authority observed, and he added, "I think that this is the case now in our relation with the United States. At any rate, I am satisfied that it is quite as much the interest of the United States today to maintain the relation of dollar to sterling as it is ours to maintain the relation of sterling to dollar, and it is about time to leave the exchange to adjust itself."

It might have been advisable, however, to have cushioned the shock by a gradual readjustment, but that would not have altered the fact that so long as our dollar is at a premium, this country will be a good one to sell in, but a poor one to buy from—which is the vital element not only in the present exchange situation, but also in the whole problem of financing foreign trade.

The solution seems to lie, as I have indicated, in the purchase here of foreign securities. We may as well understand now that we can never hope to recall all of our foreign loans, and that, knowingly or otherwise, we have invested abroad on a permanent basis. There is no doubt about our having to invest abroad some of the heavy interest due on foreign loans.

But that should prove to be one of our greatest assets, as it proved to be one of England's when the unparalleled crisis of 1914 shook the foundation of civilization. It means also that we are in world affairs on a scale never dreamed of a few years ago—and we are there to stay. Comprehending that truth, we must take full advantage of it, not only for our own sake but likewise for that of our debtors. Our prosperity now is more than ever contingent upon the prosperity of other nations. In helping them to rehabilitate themselves we are helping ourselves. And we are amply able to render the needed assistance in the form of foreign investments.

We possess the greatest national resources of any people on earth; our yearly income is greater than that of any other nation; we lead the world in production and commerce; we have the largest total of saving as well as the largest per capita savings—amounting in 1919 to $113.45 a person, and to a grand total of more than $10,800,000,000, which represents an increase of more than $2,225,000,000 since 1914. The amount of "free gold," that is to say of excess reserve, in the Federal Reserve System, which represents the surplus lending power of the system, is sufficient to support a reserve note circulation of more than $1,500,000,000, a significant index to our reserve financial power.

But investment in foreign securities involves grave responsibilities, particularly for the uninitiated. Realizing that part of this responsibility will fall upon them, our leading banks, in anticipation of the service which they will soon be called upon to render, are now studying the foreign-security problem with a view to affording their customers the largest possible share of protection.

Government Cooperation Imperative

The utmost care must be exercised in determining what foreign securities shall be offered to the American public. We shall have imperative need for expert knowledge of all factors behind these securities. Our banks can be trusted to do their part in this new field, but they cannot perform their functions fully and properly unless they and our investors have the support of our Government.

Aside from the material security which will guarantee the repayment of capital and interest, there is involved the question of property rights. These rights must be protected by the United States Government. It is high time that a policy which would afford such protection be formulated and put into practice—not perfunctorily but actively, and earnestly—so that our investors in foreign lands will be assured that, regardless of the administration in power at Washington, their property rights abroad will be defended, if need be, scrupulously and sternly.

We cannot expect the American banker, or the American trader, or investor, to start his dollars around the world unless they are followed by the protection which the American flag should afford the property and lives of our citizens But instead of having such protection assured, we have frequently and recently, and sometimes even scornfully, had it denied in Governmental circles.

Across our southern borderlands more than five hundred American lives have been sacrificed and more than $1,000,000,000 of American money jeopardized by the refusal of our Government to raise a hand in their protection. Surely there is some higher principle involved in such a situation than any theory of a "self-determination" which protects anarchy, murder, rapine and destruction, and which destroys not only the rights and lives of others, but defeats the welfare and progress of the very people for whom it is invoked.

The Railroad Problem

Another very vital post-war problem is that presented by the precarious financial condition of the railroads. Its multiple ramifications affect every phase of our business life. And the situation grows more desperate every day. During 1918 the deficit piled up under Government operation, and which is to be met out of taxation, was in excess

of $200,000,000; to which has been added more than $70,000,000, during the first two months of the present calendar year. Yet rates are 25 per cent. higher and the service poorer than ever. It is true that in February the gross earnings of the railroads increased $61,000,000 over the corresponding month in 1918, a gain of 21 per cent.; but operating expenses, which a year ago had run close to gross revenue, increased $62,600,000, or 24 per cent. And the net operating income of the railways for February was nearly $37,000,000 less than the compensation guaranteed by the Government. In January the deficiency was $55,000,000.

Under the sympathetic management of the Railroad Administration, which yesterday granted a further wage advance of $65,000,000, wage increases of $910,000,000 have been allowed. During the last three years wages have increased $1,260,000,000, and have more than absorbed all additional revenues obtained from higher rates charged for freights and passenger traffic. A revolving fund of $500,000,000, which was voted to meet capital requirements, has become a dissolving fund in the face of railroad necessities. To meet the losses in operation and capital requirements of the roads, a sum aggregating more than $1,000,000,000 for the period covering Government control has already been required in Government funds to be raised from tax resources.

The country was promised, by those responsible for this debt, that vast economy in operation would be effected, which would show convincingly the wisdom of their plan. Experience has proven that the economies effected have been negligible in comparison with the expense added; and that, on the whole, less efficient services—less satisfactory to the public and less promising for future needs—have been rendered at a largely increased cost to the shipper and the taxpayer.

Jack to Bill—Jack in the Navy

Deer Bill:

I havent rote you no leters for a long wile becaus Ive bin in the navey and a guy tole me all our leters was sensured.

A side from this and one or too uther things I likes the navey furstclas tho I doant see wy a mekanik has to bee lurned to stear ships and maik awl kines of nots, do you, Bill. But thay shure apreshates a good man for after weed bin qaranteend fore weaks tho nun of us warnt sik only one man what had the ich and Id had only but three weaks practis in maikin a bolin wen I shode it to the teecher he sed mygawd wich shose he was supprized.

And thay maid us stan on a plattform and heev the led wich thay calls fliein the bloo pijun. An tern a weal like stearin a ship. An sleap in a hamuk an seez it up (seezin meens tiein, Bill) with marlen hichis and I allus thort marlen was a gun for one of my frens wurkd in a shop ware thay maid marlen guns but thees are hichis.

But thay shure yuses fool tawk in the navey for wen we was on a reel bote not a plattform and sales set an too of us me an an uther stearin the bos sed nuthin hire so I poot my side of the weal lore to be safe an he sed giv er a full, carnt you see the wether leach shivr? And a wether is a kine of booll sheap and a leach is a blud sukker, and thay want no sukkers thare and if thay was wood thay be he-sukkers an maid into wethers? Wat foole tawk, Bill.

Thay lurned me sum abowt signulin and it was verry intrestin but wun thing in the wiggwagin I dident like. Wun of the moshuns is like the sacred sine of the Nites wat we musent yuse only but in xtreem distruss and dainjur but the lefft hand is the uther side upp so it dident seam rong to maik it wat do you think Bill?

And just befoar I went onto the destroiur I hitt my hand with a hamr and wen my new yuneform come it hed a red woon stripe on to it ware the sleev jines on to mee and evry man had wun, sum on wun side sum on the uther. Wat a lot of woons thare mus be that doant git into the paypers. An on the distroiur I seen the faymus ashcans and maid upp my mine to invent a improovment for enny wun can see thay aint bigg enuf or hevvy enuf to hert a submreen nun, but I seen a gink fiksin wun to drop an he ajustid a doodad an he tole me it was a sting like wat wassups has so I gess its awl rite.

And thay plays meen triks on ships like in shops for a guy tole me to go to the captin for the kee to wine the cumpus and I miter went only but a kine man sed doant the kee of the stabburd watch fitts it.

An Ime not aloud to tel ware we went to in frans, but its naim is like the parrt of you that wood giv millk if you evver shood giv millk wich of coarse you wunt Bill, and its a fine plaice an thare I was poot to wurk in a masheen shop on a ship cawled a muthr ship mendin distroiurs and such and I run a laith like the wun I hed wen I was alernin to be a laith speshlist you no Bill.

An wun day I cutt threds an the bos sed I dun noable and awl he hed to do was to putt on the geers and sho me how jus wuns an I cut six in a day a ninch and a half long 8 pich. An wun ship we repared the enjuns of dident hav no enjuns but turr beans an I nevr new befoar wy thay cawld um that and a kine man toald me becaus its as full of blaids as a podd is of beans. Aint it fine to keap alernin things Bill and yuseful things to.

And frans is fine only but it ranes evry day and a french gurl giv me a convsashun lozzungur and on it it sed vous êtes très méchant, and warnt she brite to see that Ime a mekanik and yit thay doant no how to spel it, an french is a qeer lingo for you has to tawk it difrunt to a man or a woomun. Youd hardly bleev that, Bill, but wun of the men he lerned to say good mornin like donny mwa un bezzay and he sed it to a gurl an she was so pleezd she up and kisd him but a bigg buc frenchman with wiskers got madd wen he sed it to him. An eavn the kids are hily ejucaitid and swares in french, our country is farr behine in sum things Bill.

An yit sum of the groneups carnt understan thare own tawk fer I was in a restrunt and a man ast fer too dur sweet and the gurl brort him fride egs so I ast fer um too and she dident no wat I ment and dident bring me nuthin and I gut upp and beet it.

An a frenchy come to the shop wen I was runnin the laith an he pointid to the thred and sez vees and I sed, reel nise and kine, no them thare is the Vees and he sed vees, vees, and I tole him he was a lire an he beet it. An thay doant no no betr than to cawl a munki rench a clay anglay. But I gut tiurd of wurkin in the shop and not gittin no Croycks de Gerry nor nuthin and aplied for to be transfurd to the mreens thay beein the furst to fite an so most proberly the furst to come hoam, but nuthin dooin, and wen the armstis come I dident bothur no moar abowt it and now Ime agoin to start fer hoam soon an Ive rote to the ralerode shop ware I yuesd to wurk an ast if thay want me for foarman, Ime qalerfide for super but wood hait to beet him out of a jobb, an wen I gits to New Yawk Ile rite you so no moar now. JACK.

P. S.—Bill the males aint runin none too good but if you doant git this lett me no and Ile rite anuther as soon as I gits hoam.

The Stabilizing Effect On American Industry Of a Definite Foreign-Trade Policy*

By JAMES W. HOOK
President, Allied Machinery Co. of America.

IT HAS seemed to me that the subject I have been asked to discuss will admit of extremely wide limits of treatment. A definite foreign-trade policy quite rightly embraces every phase of export selling. It includes a shipping policy and the laws that govern same. It includes a financial and credit policy. It involves the products we have to export and their peculiar adaptability to various methods of export selling. To treat this major policy with all of its subordinate issues and express its effect on American industry would, I fear, consume more time than I have at my disposal. I shall therefore take some liberties with the subject and limit myself to a discussion of what I consider to be a cardinal, if not a vital, factor.

There is no denying the fact that the world war had a permanent effect upon America's aspect toward foreign trade. The great demand for almost everything caused an expansion of producing capacity in the United States that today is greatly in excess of the home demand. Export markets must be sought, new methods of selling must be introduced, and the same thoughtful consideration must be given to overseas trade that in the past has featured our highly developed trade characteristics at home. America, perhaps more than any other nation, has learned the art of handling her home markets. She has met the needs of a discriminating demand, and men from other nations tell us that no people on earth are harder to please than our own Americans. They are keen traders and extremely sensitive in matters involving the quality of the merchandise they buy; and, in their demands for service, no people can surpass them. Similar fastidiousness on the part of foreign buyers need not unduly disturb us, much as that bugaboo has been flaunted before us in the past. No people will do more to offer and perform a real and satisfying service to buyers of their merchandise, once it is known what that service should be, than Americans.

The world war has had a permanent effect on the American aspect of foreign trade. Our industrial capacity has increased many fold and if our industries are to be kept running at maximum output an increased amount of their products must be marketed abroad. That American goods shall be properly represented in foreign markets we must no longer depend on foreign selling agencies but must build up selling organizations of our own. As we are specialists in manufacture so must our selling organizations be made up from specialists, trained in the particular lines of goods they are to handle. If our manufacturers will insist on American goods being sold abroad by American organizations many of our export troubles will be lessened.

I am a great believer in the theory that American goods should be sold abroad by Americans. I say this perhaps in a general sense, for it is well known to everyone that native salesmen under American leadership are often necessary. But we should have the American leadership. We ought not to go back to pre-war days when the American producer handed over his foreign selling rights to foreigners, who, in a great many cases, only tested the market with American goods and then manufactured these goods as competitors.

Pre-War Conditions

We only have to go back to the beginning of the war to see the dangers of this practice. Then hundreds of manufacturers in the United States, who had depended wholly upon foreign agencies for their export business, suddenly found a large portion of their foreign selling organization destroyed. Then, and only then, did it dawn upon them how utterly dependent America was upon foreigners for much of her export trade. The situation might have proved disastrous to many had not the war assumed such proportions as to tax the producing capacity of the entire world. This great demand enabled manufacturers to make new connections with other selling agencies; but many of these were not serious in their intentions and are now rapidly going out of business.

Regardless of this experience, American capital and American manufacturers have not prepared for the present-day conditions that the simplest foresight made apparent as the war progressed. I refer to the creation of American selling agencies abroad. We were too busy; our huge war orders blinded us to the future. Manufacturers would not look forward to the means they would adopt to obtain export business when their war orders ceased. Largely as a result there are today few purely American agencies operating in foreign markets. Many manufacturers therefore find it necessary to rush to Europe and elsewhere to make new selling connections.

If there was an incentive before the war for Germany to test the market with American goods and then manufacture them later, the incentive now is many fold greater. If any foreign nation, before the war, could regulate the amount of American material entering her ports by controlling its sale, her incentive to do so now is infinitely greater. Huge domestic and foreign debts make it obligatory upon the part of all former belligerent countries to produce everything they can and to import as little as possible.

Much as we desire to lessen the burden that the late belligerent nations must bear, we cannot disregard fundamental principles; moreover, the business men of other nations do not expect it. They need our products and it is only natural that as long as they create and control the demand we should control the sale of our own merchandise.

It is a formidable barrier to foreign-trade expansion that the manufacturer builds around himself when he entrusts his foreign selling to any foreigner. England and Germany follow no such practice, and, as we all admit, their long experience in developing foreign markets has made them past masters in the art.

America must immediately enter upon the serious business of building a foreign selling organization. She must not operate through foreigners any longer. She must lay the foundation of complete independence from every nation in the world in all matters involving her export trade. She must deal with the problem in a specific and practical way. Producers who have products to sell abroad want to be specifically shown the step-by-step way of doing it. Talk of trade balances, exchange fluctuations, or the probable intrinsic value of a silver dollar five years hence, does not specifically interest them. Once a feasible and workable plan is devised—and many have been—they want it developed so they may take advantage of it.

In a large sense America has come to be regarded as the great specialist manufacturer. Take machinery for in-

*From an address delivered before the Sixth National Foreign-Trade Convention, Chicago, Ill., Apr. 24 to 26, 1919.

stance. The enormous demand caused by high labor costs has enabled the manufacturer to build up a large and paying business by manufacturing one single line or commodity. As a result we find such manufacturing specialists all over the United States. In Providence, Rhode Island, and Cincinnati, Ohio, we find large manufacturers making nothing but a limited line of machine tools. In Holyoke, Mass., is another factory making nothing but textile machinery. And if we look again we find other manufacturers specializing still further. In Milwaukee is a manufacturer making nothing but milling machines; in Cleveland is another making nothing but turret lathes. America is the only country in the world that has a domestic demand for machinery that will warrant such specialization. Therefore, we find that manufacturers of other nations must make many kinds of machinery and specialize in none. The result is a supremacy of the specialist—the American manufacturer—who not only produces cheaper but also leads in design and quality.

Fundamental Requirements

The advantage here (and it is not confined to the machinery industry) is something tangible and can be capitalized in foreign trade. It involves an export selling organization which has obtained exclusive rights by contract from non-competing specialty manufacturers in America to sell their lines in certain foreign markets. It buys the product outright from the manufacturers and stocks it all over the world in reasonable quantities. The significant thing about the plan as just stated is the word "non-competing." No export house operating through contracts with manufacturers can successfully sell competing lines in the same market. This is the first fundamental requirement, regardless of whether the export selling organization involved is owned by the manufacturer or by outside capital.

The second fundamental in such an arrangement is the specializing of the export selling organization itself. It must avoid obligating itself to sell lines which require different kinds of a selling force. Specialized selling abroad is as important and necessary as specialized manufacture at home, and it offers the same advantages.

Another fundamental principle involved in this plan of export selling is the attitude exhibited between the manufacturer and the export selling organization. Regardless of whether the export organization is or is not owned by the manufacturer, the economic problem involved is just the same. In either case the selling force, as far as the actual sale of his product is concerned belongs to the manufacturer. It is all the selling force he has in that particular market. He should, therefore, treat it in just the same way in regard to protection in prices, prompt shipment, and careful service, as he would if it were supported directly from his own treasury. He must realize that while the export selling organization may buy a stock of his product no sale is really made until it is delivered into the hands of the ultimate consumer.

The fourth fundamental is the faithful consideration given by the export selling organization to the obligation it is under to the manufacturer. Many people fail to see the need of such a medium between the manufacturer and the customer abroad. "Why not sell direct?" they say. Whether a manufacturer can sell direct or not depends upon the demand. When the demand warrants it, direct selling of course is the ideal one. But there are in America comparatively few manufacturers whose business in foreign countries alone warrants the establishment of a special foreign sales organization. When such a demand exists manufacturers often find that it is wiser to manufacture in those countries.

Selling Organization

The export selling organization must feel its obligation toward the manufacturers it represents. It must feel that it is a part of their organizations. It must insist upon the manufacturer considering it in that light. It must realize that it is intrusted with all the duties that must naturally be assumed when one undertakes to market goods abroad. And what are these duties?

First, and foremost of course, is the creation of a competent selling organization. This involves proper sales managers with salesmen of local nationality. These salesmen must be properly trained. One by one they should be brought to America and put through a course of training in the plants of the manufacturers whose goods they will sell. Above all, this selling force must be loyal to the manufacturers. In this it must have no reservations, no limitations. Its whole aim must be to import and sell American goods. And, if it must have salesmen of local nationality, it must also have American leaders—men who can inject American push and spirit into the selling problem. The training of this force is of paramount importance; and, whereas the salesman of local nationality should be brought here for training, so must the American leaders be trained for the new land to which they have been assigned. No one with experience in the export field fails to realize the difficulties that attend the selection and training of the men they send abroad.

Back of the selling force is the administrative organization with its departments for dealing in exchange, traffic, credits, shipping, stocks, collections, customs, insurance and corporate matters.

Departmental Experts

The proper handling of all these matters requires experts in every department of the export house. Before the war, foreigners realizing this, and capitalizing America's provinciality in the matter of foreign trade, came here and formed great trading companies for the purpose of selling our products in foreign countries. One such company before the war did an annual import and export business of some $30,000,000 per year with South America. Other foreigners obtained the exclusive selling rights of some of our best manufacturers. This resulted in a large share of our export trade being in the hands and under the absolute control of foreigners.

Shall we revert to the same practices again, now that the war is over? Or, will our manufacturers insist upon American goods being sold abroad by American organizations? If they will insist, more of such organizations will be created. These in turn will encourage the creation of better American banking facilities throughout the world. Better banking facilities will encourage American investment in foreign securities and industry, which in turn will produce permanent markets for American goods. Such a definite policy of handling our foreign trade will insure that America with all of her vast resources of raw materials and creative genius, will take her place beside the other great trading nations of the world.

The Time-Study Man or Rate-Setter

By Gaylord G. Thompson

We have read with interest of the many qualifications, as set forth by various writers, that must be possessed by the individual who aspires to be a foreman; likewise have we assimilated the diverse opinions as to the subtle characteristics that distinguish the draftsman from the engineer; but there is still an individual who has thus far escaped the literary barrage laid down by the long and short range pens of various authorities, and that is the "time-study" man.

While this minor official has not yet assumed proportions of importance in public print, he is by no means a negligible factor in our industrial life. He is, however, without a definite name, having had various monakers wished upon him, such as "time-study man," "task-setter," "speed boss," and sometimes "efficiency man." It is in the hope of stimulating discussion and perhaps arriving at a definite conclusion as to his correct designation and standing that this article is written.

Let us take for example a man who, building upon

the groundwork of a long period of practical experience in mechanical lines, having become well versed in speeds and feeds, methods of handling and routing work, etc., having the gift of concise and exact expression, and having developed a sense of responsibility, considers himself an expert time-study man. This man, whom for the sake of convenience we will call William, sees in one of the technical journals an advertisement the requirements of which, while not quite clear to him, seem to be met by the qualifications he possesses, and he decides to make application for the job.

After passing the outer defenses, he is finally ushered into the presence of the superintendent who wants to know what he can do. William starts out to detail his qualifications but is met almost immediately by a shake of the superintendent's head and the statement that "we have no opening for an efficiency expert; all we want is a rate-setter, one who knows enough about the methods of production to know whether or not a workman is trying to 'put something over on him' to gain a premium or higher piece-work rates than he would normally get."

"But," replies William in surprise and consternation at being taken for an efficiency expert, "I do not claim to be such; I am merely a time-study man."

William Pleads Guilty and Lands the Job

After some discussion as to the applicability to specific duties of the terms "efficiency expert" and "rate-setter," William pleads guilty to the latter and lands the job.

After being on the job long enough to get a knowledge of his duties, he is still further surprised to discover that it is the very job he has been seeking; that his qualifications were being put to the severest test. His analyses were required to be exact in the matters of elapsed time and details of operation. He was held responsible for speeds, feeds and methods of production, and was vested with a somewhat limited authority to make changes. In short, William was called upon to assume the duties of an expert; to reduce costs and increase production.

In view of these requirements, is not the term "time-study man" the correct designation? The setting of a rate was merely the effect brought about by scientific analysis. It was not the number of rates set per day that determined the measure of William's efficiency, but rather how much he was saving his employers in production costs. He was allowed to take whatever time on each analysis that was necessary to make certain of logical and correct conclusions. The result was that William effected a saving amounting to many thousands of dollars a year by the introduction of more efficient production methods, whereas, if he had been required to return a certain number of new rates each day, in the endeavor to live up to the schedule many inefficiencies would be bound to remain unexposed.

Working as a "Time-Study" Man

After a lapse of time we find William employed under the title of "time-study man" in another plant, where rates had already been established but with some few exceptions upon which he was able to demonstrate his ability to make scientific analyses, reduce costs and increase production. Again William felt that here was his chosen line but under a different title.

His complacency was, however, short-lived. There soon came a complete change. New machines were installed, old machinery rearranged and the manufacture began of new parts upon which rates were to be established. Workmen were complaining that their wages were too low, the hourly rates having been purposely set low in the expectation that the piece rates and premiums would bring them up to standard.

William had at this time attained the position of foreman of time-study and was besieged from all sides by foremen and workmen alike to establish rates on the jobs going through the shop in order to restore wages to a normal level. Right in the midst of all this trouble William was informed that two of his time-study men had been laid off. William sought an immediate interview with the superintendent and endeavored to demonstrate to the latter why his men should be retained.

"How many analyses do you think should be the daily average of each time-study man?" asked the superintendent.

"That depends upon the size of the job, the working conditions and ——"

"No! No!" interrupted the superintendent, "there is a conservative average to the number of time-studies to be expected from each man daily. Let me cite you an example," he added, "at Blank & Co. Their time-study men turn in an average of from 15 to 20 studies per day, and if they can do it we can."

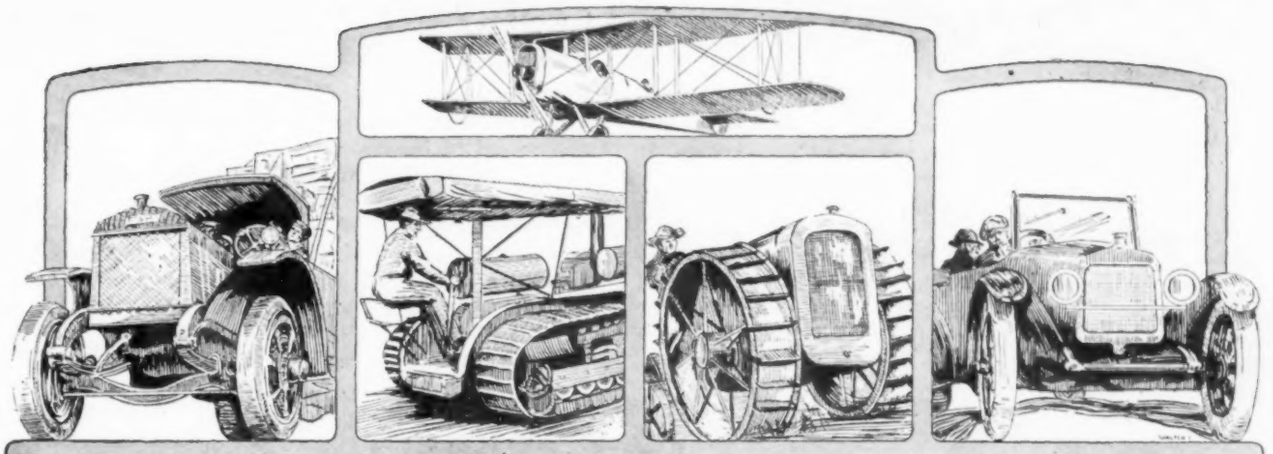
After the interview William returned to his studies undecided as to whether he was a time-study man or a rate-setter. His thoughts drifted back to his previous position where he had been employed under the title of "rate-setter," but where his efficiency was determined by the money he was earning for the company rather than for the daily number of rates set. He compared this position with his present predicament where an average number of rates set per day was to be his schedule. To meet this arrangement would make it necessary for him to slight his work.

Titles Should Have Been Reversed

It dawned upon William's mind that the titles in his two positions should have been reversed, he should have been "time-study man" where he had been "rate-setter" and vice versa. The principal requisite in the first instance was scientific analysis and in the second he was chiefly concerned with rate-setting.

The question is, to which employer was William most valuable? To the first where he saved thousands of dollars without reference to the daily number of analyses made, or to the second where 15 to 20 studies per day were required regardless of the merits of each case or the thoroughness with which it was covered?

It is easily discernible which of the two concerns are getting the best results. The first concern rated their employees high enough so that there was no dissension when they were called upon to work under the hourly rate. The saving by increased production, made possible by the allowance of ample time to investigate each case upon its merits, more than compensates for the difference between the high and low hourly rates. This is a case of increasing wages to reduce costs. The second concern, where low hourly rates prevailed, because of this very condition, found its costs increased by reason of the fact that this condition was conducive to haste and ill-considered methods of setting rates in order to keep the workmen satisfied. This is a case of keeping wages down and increasing costs.



AUTOMOTIVE CONSTRUCTION

What One Manufacturer Learned About Motor Transportation*

By F. G. KANE

The motor truck as used in the delivery and hauling service of the big manufacturer is still enough of a novelty to be treated much as was its predecessor, the horse and wagon. When the owner treats it as he does his expensive production machinery and takes as much pains in keeping track of its costs, he may expect results which agree with the claims of the salesman.

ONE of the largest of the machine-tool manufacturing concerns recently uncovered a situation in the transportation department which had neither been suspected nor considered. At no period in this business has the going ever been easy. Profit margins were always narrow as is characteristic of staple necessities. Each year's earnings depended upon an increased volume of business, with the most minute and accurate cost records for every department, so that economies might be effected and leaks stopped. The best technical minds available were centered on each phase of the business, from the testing and purchase of raw materials, through the intricate processes of the factory, and right up to the packing of finished goods for shipment at the factory door.

Almost by chance the management discovered that the motor transport was far below the standard of efficiency maintained in its manufacturing and distribution. Accidental comparison of two sheets of cost figures aroused a suspicion as to the efficiency of one section of the motor transport, and then it was found that the records did not furnish a basis for thorough analysis, because they were incomplete.

At this point the company's motor-transport problem was submitted to experienced transportation engineers, with a request for investigation and suggestions. The engineers found that the motor equipment was operated in two widely separated cities, in each of which the company had a good garage with its own system of cost records. But the system followed in each place was different. Both sections of the motor fleet were under the supervision of men who had risen from the ranks of drivers. Their experience in operation, mechanical upkeep and management of men was excellent, and they were entitled to commendation for high standards in keeping equipment actually at work, and for good human organization. But they were not familiar with accounting, much less scientific cost management, and when each devised his own cost system, it was naturally limited to details with which he was most familiar. For example, blanks were provided for keeping track of items like gasoline, oil, tires, repairs, garage expense, wages of chauffeurs, helpers and mechanics. From these records a sincere effort was made to figure out general operating costs in miles, tons, days of operation, cost per mile, cost per ton and cost per ton-mile.

The first inspection of the motor equipment itself by the engineers revealed the fact that not one of the 60 vehicles had a speed or distance-recording appliance in good working order. This reduced the figuring of ton and mile costs to rough estimates. It was also found that rule-of-thumb methods had been largely followed in keeping track of gasoline, oil and the like. A clerk intrusted with recording these items would perhaps ask a driver how many miles he made to a gallon of gasoline, and if the driver replied, "About two miles," the busy clerk in good faith said, "Well, you had 20 gallons of gasoline today, Jim, so you must have run about 40 miles," and 40 miles would probably be entered on the records as the performance of that truck that day.

A motor fleet of that size necessarily consumes large quantities of supplies, such as tires and parts. In neither garage was there any stock-keeping system for supplies. No correct inventory had been made for years and no correct pricing of the different materials for quick, accurate debit entries against each motor was

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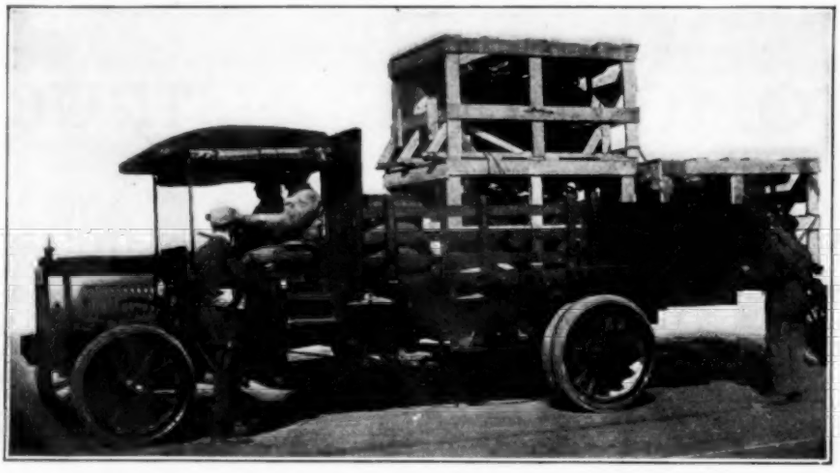
AUTOMOTIVE CONSTRUCTION

on hand. The company was compelled to merchandise its products in the light of accurate cost records and pricing, but it had never made any effort to merchandise the supplies used in its motor fleet.

Even if each garage superintendent had worked out a satisfactory system of records for the above items, which gave a faithful accounting day by day, with the lack of uniformity in the two systems, it would have been impossible to make fair comparisons. As a matter of fact, when the general management tried to run down obvious discrepancies the cost records were not capable of comparison. Furthermore both systems were deficient in monthly and yearly summaries, whereby identical items of experience could be compared, one month with another, and one vehicle with another. Thus hundreds of wastes and leaks were possible and could not be corrected because they could not be found. For the same reason many genuine economies and efficient operating methods were concealed and could not be brought to light and turned to advantage.



THE MOTOR TRUCK IN THE MANUFACTURER'S SERVICE

This company's motor equipment includes vehicles of various makes, types and capacity. Records did not show which maker's cars were most efficient nor the sizes and types of vehicles best adapted to that business.

Among the 60-odd drivers there was a wide range of ability. Records did not reveal the incompetent man, nor furnish a basis upon which to overcome his shortcomings by instruction, or by directing his attention to important factors of operation. Nor was it possible to discover the most efficient drivers and make their methods available to others. Real injustice was often done drivers because they could not be given credit for skill, carefulness, economies of fuel and supplies, and other praiseworthy service to the company.

What this company learned from a verbal report, following a brief investigation of garage records and methods by transportation engineers was, that it had never secured a clear mental picture of its motor equipment, much less of its motor transport requirements.

The engineers were asked to study the situation further and make recommendations. They began by ascertaining the kinds of material to be hauled, and made a study of the territory to be covered with reference to distances, systematic routing, character of pavements and roads, branch distributing points, facilities for quick loading and unloading at freight terminals, etc. Then followed an inventory of motor equipment in use, as to make, type, capacity, age, condition, kinds of bodies and general suitability to service requirements. This included a study of idle equipment during slack periods and a maximum use of motors during busy periods with investigation of the outside trucking service required in busy seasons.

With this groundwork of facts the engineers were assigned to ride routes with drivers, keeping accurate route records of gasoline, oil and supplies, mileage, time spent on each trip, time of loading and unloading, time lost by delays of every kind, whether due to mechanical mishaps or outside causes, such as waiting at terminals.

Route records were worked out in terms of cost and hours, with almost startling discrepancies revealed in actual ton-mile values between two vehicles which had been credited with identical performance. It was found that, because garage superintendents had no trustworthy figures of cost for vehicles of various types and capacities, freight hauling and delivery service were not clearly separated and vehicles of widely different character were used indiscriminately for all classes of service. A heavy truck might be subjected to too many stops and waits by reason of the kind of freight carried, while lighter vehicles were used in hauling solid loads over direct routes when they should have been assigned to mixed loads with many stops to relieve large trucks of peddling work.

Opportunities were also found to get the drivers' viewpoints on important matters such as causes of delay at terminals, mechanical mishaps to equipment, the efficiency and dependability of different motors, the convenience of bodies, and loading and unloading devices, their feeling toward the company, their interest in efficient operation, and so forth.

As an upshot of this investigation the company is now using the National Standard Cost System adopted by the Truck Owners' Conference, which is recognized as fully covering every essential point of motor transportation costs, and possessing a flexibility which permits its application to motor transportation plants of every size and character. Furthermore it now recognizes the difference between motor trucks as an important auxiliary service, tacked loosely to the outside of its business, so to speak, and real motor transportation as incorporated into the business, taking its place as part of the whole process of production, from import of raw materials to final customer deliveries.

Taking this view, motor transportation is machinery. It eliminates hand labor, boosts up output, reduces cost. It demands study as machinery. It demands scientific management, as well as cost keeping. It is an intimate part of the industrial equipment and the factory process,

AUTOMOTIVE CONSTRUCTION

and should be so regarded. Only on that basis will it yield maximum production, and any other basis of operation is unfair, both to the motor equipment and the business itself.

In delivery and hauling by horse and wagon the equipment was looked upon as an auxiliary, if not a necessary evil. Investment in a horse and wagon was small compared with the motor truck. The average motor truck represents an investment of at least $3000 while a horse will cost about $350 and a wagon about $500. Motor trucks operated by the business concern whose experience was dealt with above, cost $6000 each. The horse has a limit of travel and work; he will haul 1½ tons maximum about 18 miles a day. He could be driven 10 or 12 hours daily and then had to rest. When he was not busy his owner felt satisfied because he was at least resting and could later be called upon for work. The relatively smaller cost of investment and driver's wages led his owner to look upon loss by idle time as negligible. When motor vehicles were substituted for horse equipment the owner persisted in regarding them upon much the same basis, as auxiliaries of the business instead of costly, high-capacity machinery of an entirely new type. A 5-ton motor truck will travel, on the average, 50 to 60 miles a day, carrying from three to four times the load of a horse truck. It requires no periods of rest but can be kept running twice as many hours as a horse. In other words, it is modern high-power equipment, and requires an entirely different viewpoint.

Employment "Systems"

By John P. Commentz

In nearly every industrial magazine one picks up today are articles on employment, setting forth ideal methods of obtaining the help that is needed in our factories all over the country. One writer starts by saying that a "straight line is the shortest distance between two given points," and then proceeds to lay before the reader a most wonderful system, incorporating organization charts, card indices, applications, applicant's introduction to foreman, applicant's acceptance, applicant's engagement, etc., together with a record folder to contain all the data collected in open file while the applicant is in employment. When the employee leaves, this folder with contained information is transferred to the closed file.

Now I am not aiming at any particular system, for I know that all large as well as small business enterprises of today should have a well-oiled routine in which they should run, and that all departments working in harmonious coöperation makes for their successful management.

From the writer's personal experience covering the last five years, especially during the war, this straight line between two points has been sadly neglected. It was rather a long line which led around Robin Hood's barn before the applicant was brought face to face with the individual who would ultimately decide whether or not he would be hired.

Employers were crying for men, especially skilled mechanics, and the response of the unemployed was inadequate to meet the requirements. With the Government forcing men to leave their positions and enter war industries, matters were still more complicated.

Let me illustrate one instance of this: One of the largest airplane-motor plants in the East made preparations to hire about 10,000 men within the space of four months, most of whom were to be skilled workmen. Advertisements were placed and from early morning to late at night a line of men extended some 300 or 400 ft. from the employment office with as many as 300 men inside waiting to be interviewed. Each man had to take his chance in line, consequently men would lose a large part of the day before they could come within range of the interviewer, who, with the aid of a micrometer, would ask a few questions as to name, age, nationality, experience, etc.

Now what happened? One out of 20 or 25 men would prove acceptable to the interviewer who would pass him along to the foreman to be accepted or rejected; and one man out of 10 so passed along would be accepted by the foreman. Men turned away today would be accepted tomorrow by some other interviewer who was perhaps a better judge of men or understood mechanical matters better than the other.

The work of the writer at that time was largely in and around the employment department, and at times he could not help overhearing remarks made by the men. "Well," said one of them, "I have been here three hours and will not stay any longer. If they want a mechanic I am here, but I do not intend to stand around all day." This man, like others, was justified; good mechanics would not stand in line for hours; it meant bread and butter to them and each day out of employment set them back so much more in money and lost time.

Men refused by one foreman, because he felt that they were not fitted to fill the position, would be accepted by another, and perhaps prove to be most efficient. Again men refused by interviewers were brought in contact with foreman and accepted. One thing of which we may be certain is that not all men are qualified to pass on the merits of others.

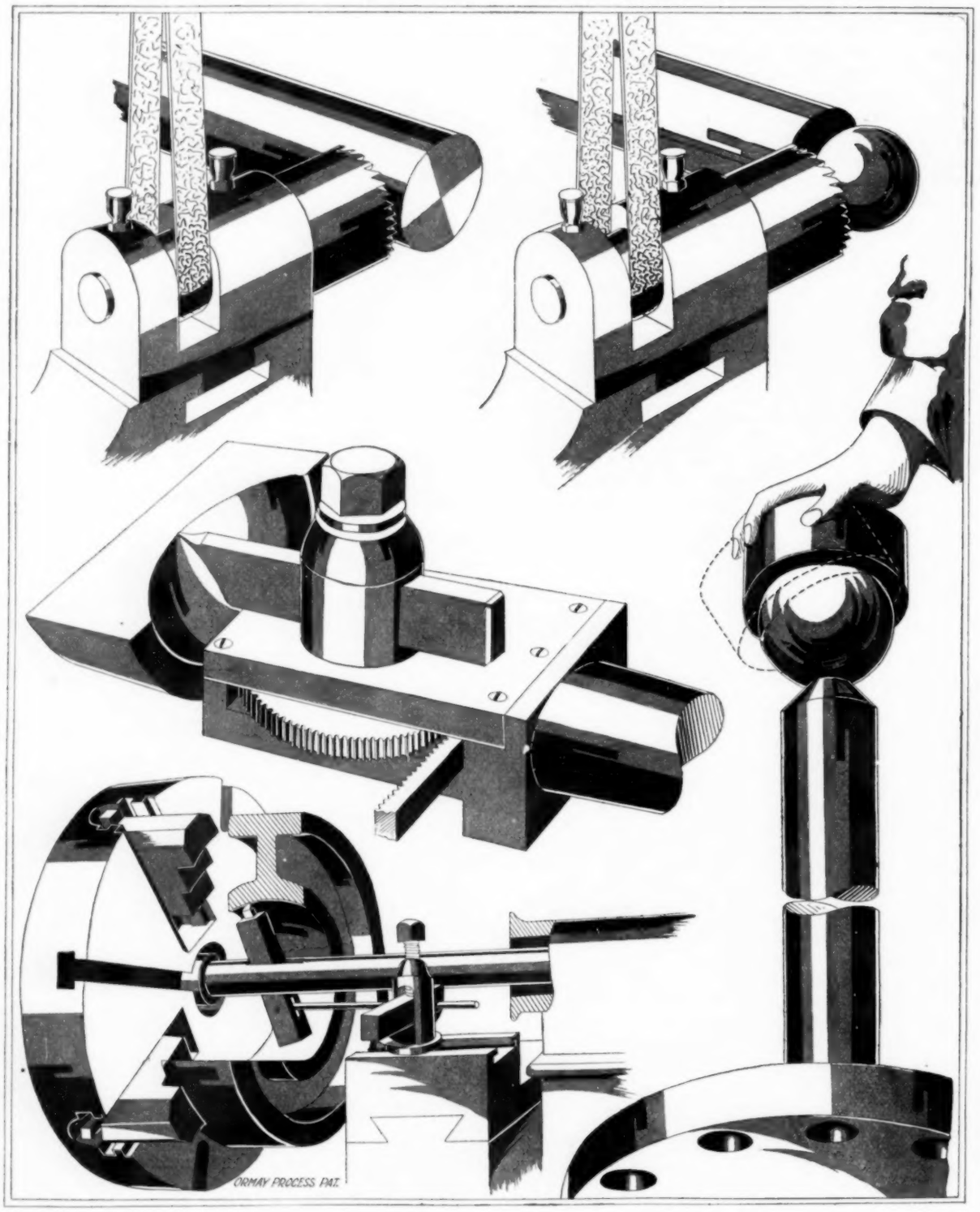
A case that was brought to the attention of the writer was that of a man who, with an experience of seven years as an accountant in two of the largest concerns in the state, applied for a position in the accounting department, and was turned away under the plea that he lacked experience. The Government later accepted him with a rating of 81 per cent. on his application and immediately placed him in a $2400 position. This man was acceptable to the employment supervisor, but was turned down by the office executive, yet he proved so efficient as to handle a staff of 40 men under the Government.

Planning an Exposition in Norway

Efforts are being made to hold an exposition in Christiania, Norway, in the summer of 1919, which will include all branches of American goods. This has the approval of the American minister at Christiania. The idea is an excellent one, because, since the outbreak of the war, Norway has come into closer commercial relations with America.

FOR SMALL SHOPS *and* ALL SHOPS

By J. A. Lucas



METHODS FOR TURNING SPHERICAL SURFACES

American Machinery In Australia

Bureau of Foreign and Domestic Commerce

Australia being widely separated from industrial nations must perforce depend more and more upon her own industries for many manufactured articles for home consumption. This means that she must produce and keep in repair an ever-growing volume of machinery. To do this, machine tools of every description will be needed, the demand for which will offer to the American machine-tool builders a promising outlook for a permanent export market.

AUSTRALIA is rapidly becoming a manufacturing country and the demand for certain American machinery and machine tools is increasing. As a majority of the engineering establishments are also jobbing shops, the engineers in charge are averse to buying from catalogs but desire actual demonstrations, especially of new machines, and the majority of sales are accordingly made after a sample machine has been received by the agent or importer. A substantial additional discount on introductory orders should be allowed, particularly in highly specialized lines, as otherwise there is not sufficient incentive to warrant the importer taking the risk of the machine not being a success. Types of American machines, which have subsequently enjoyed exceptional sales, have been kept off the Australian market for years because the manufacturers did not put a sample machine into the hands of a good agent and were finally introduced by the importer who took a chance on their success.

Location of Manufacturing Industries

The majority of the manufacturing plants and the largest engineering shops are situated in Sidney, New South Wales, and Melbourne, Victoria, which places produce an equal amount of manufactured goods. The former took 53 per cent. of the imports of machine tools in 1916-17, and the latter 37 per cent. The territory of Queensland, however, with its rapidly expanding meat trade and meat-canning industries will show an increased demand for machinery and machine tools in the next few years, although taking only 4 per cent. of the total imports of machine tools in 1916-17. The same is true of Western Australia with its gold-mining developments. Wool and textile manufactures are the leading industries in Victoria and New South Wales, and their growth has been hastened by lack of shipping facilities which has cut off Australia from foreign markets.

Exclusive Agency Most Acceptable

The exclusive agency is accepted as the most satisfactory method of selling machinery and accessories in Australia. Some of the established agencies have certain circles of customers, but progressive agencies make themselves of general service to all customers. Moreover, in a country like Australia where vast distances must be traveled seeking orders and modern machinery is just being introduced, it is only fair to the agent who has stocked a machine, which may sometimes prove unsalable, that he be protected by an exclusive contract. If proper care is taken in the selection of a progressive house there is little fear that an arrangement will be used to stifle competition, such firms generally being just as anxious to develop business as the manufacturer.

Since the war, Australian importers have arranged for cash payments against documents in New York, and there is little probability of an early return to the old method of sight drafts with documents. The price list in almost universal use in Australia is made on a small loose sheet punched with three ¼-in. holes at 3 in. centers. The advantage of conforming to such styles of price lists and insuring the maintenance of complete files of prices is apparent. This same suggestion holds good with reference to delivery information sheets and sheets showing machines in stock.

American War Deliveries

The Australian import agent seems to have legitimate fault to find with the American manufacturers' optimism in making delivery promises. It is, of course, open to question whether under the abnormal war conditions any industry can function with the same precision as in peace times, and now that peace is at hand American manufacturers will be quick to convince Australian importers that they are ready and willing to make as satisfactory deliveries as other countries. All the Australian agent seems to request is that orders be delivered in the same rotation as received; any other treatment is not only unfair but a source of embarassment and expense to the importer who has given his customer a specified date of delivery. Perhaps the importers would not complain if they were quoted definite dates of delivery even three times as long as those given, as they would then know what to expect and could explain to their customers. But a short-sighted policy of accepting all orders at delivery dates impossible of execution is to be avoided.

Information and Instructions Wanted

Foundation plans, instructions for setting up, and information regarding the working of machines are all greatly desired. Such information is usually the sole guide of the employees who operate the machines, and in many cases newly introduced types of machines can be satisfactorily set up in no other way than by following printed instructions. In one instance a fairly intricate automatic gear-cutting machine was ordered and instructions specifically requested, but no attention was paid to the request. When five more of the machines were ordered the same thing occurred, so that the matter could not be attributed to oversight.

The Australian importer is a close reader of the leading American machinery trade journals, and information regarding new types of machines is often requested on the strength of these advertisements. Naturally the importer who writes for a particular machine is interested in other types and a sale of some other machine might be effected at once if other catalogs were sent, whereas the order for a similar machine is placed with a competitor of the manufacturer because of this lack of business foresight. This situation will be better appreciated when it is realized

that under present conditions it requires 10 weeks for a letter to reach Australia and a reply to be received. For this reason it is sometimes advisable in case of unstable price conditions to state that prices will hold until a definite date, so that the Australian merchant will be able to cable his order in case the letter is delayed.

Practically all machinery is subject to customs tariff in Australia and must undergo inspection, and for this reason it is preferable to leave one board on the top of the case not hoop ironed and nailed but simply screwed down. This board should be located so as to allow a good view of the machine. The loading and warehousing facilities in Australia are not the best, and few cranes are employed, so that strong packing is desirable.

Machines in Demand

Lathes are the most important essential in the machine shops which are springing up in Australia. As the majority of the work of these shops is jobbing, the machine tools should be universal. Gap lathes, for instance, permit one machine to cover a large range of work and are very popular in Australia. One American machine of this universal type has enjoyed a very large sale. Most of the American gap lathes before the introduction of this one were cheap, and light tools are not in demand. A popular lathe of English manufacture has very large bearings and a rugged headstock which appeals strongly to the Australian market and is in more universal favor in large mining shops than any other tool.

The price of American planing machines as compared with those of English make is disproportionately high. Though the American machines are very high grade with a number of automatic and convenient feeds, these conveniences have made the price too high for the Australian market, and at present there are not half a dozen of these machines in use in that country. A moderate-priced simple planing machine could be introduced to advantage. This is equally true of punches, shears, rolls, and other tools used in shipbuilding and structural work, our price of which is out of all proportion to the prices of British makes.

Table I shows the increase by countries in imports of machine tools since the beginning of the war.

TABLE I. INCREASE BY COUNTRIES IN IMPORTS OF MACHINE TOOLS FROM 1914 TO 1917

Imported from	1914–15	1916–17
United Kingdom	$265,039	$424,846
United States	226,307	407,618
Germany	9,081	.....
Sweden	6,964	1,883
Belgium	4,993	.....
New Zealand	1,153	5,767
Canada	3,236	4,803
All other countries	346	8,370
Total	$517,119	$853,287

Table II shows the principal lines of machinery, imports of which have increased during the past five years, and the countries of origin of these imports in 1916-17 are given in Table III.

TABLE II. KINDS OF MACHINES WHICH SHOW INCREASED IMPORTATION FROM 1912 TO 1917

Kinds of Machinery	1912	1913	1914–15	1915–16	1916–17
Cream separators	$445,674	$510,389	$311,295	$266,636	$468,313
Harvesters	306,015	376,059	669,090	88,634	691,247
Mowers, reapers and binders	534,775	789,740	472,722	793,400	639,585
Dynamos up to 200 hp.	1,803,885	1,910,802	1,668,265	2,230,419	1,987,060
Electric starting apparatus	415,706	357,882	431,551	437,975	519,747
Weighing apparatus	195,599	191,672	192,120	223,902	211,479
Total	$3,701,654	$4,136,544	$3,745,043	$4,040,786	$4,517,431

TABLE III. COUNTRIES OF ORIGIN OF IMPORTS GIVEN IN TABLE II

Kinds of Machinery	United Kingdom	Canada	United States	Sweden	All Others
Cream separators	$13,178	.....	$11,441	$430,826	$12,867
Harvesters	.....	$448,248	242,999	.....	.....
Mowers, reapers and binders	14,069	273,186	352,315	.....	14
Dynamos up to 200 hp.	766,459	5,265	1,148,932	27,409	40,455
Electric starting apparatus	225,908	78	292,121	1,148	492
Weighing apparatus	124,680	638	84,755	.....	1,406
Total	$1,144,294	$727,415	$2,132,563	$459,383	$55,234
Per cent. of total	25	16	47	10	2

The decrease in imports of the classes of machinery given in Table IV is attributed mainly to war conditions involving scarcity of tonnage and an abnormal demand on the machinery manufacturers at home, although the fact that the number of establishments in Australia using machinery increased from 9264 in 1910 to 11,438 in 1915 with an increased horsepower requirement from 298,601 to 504,834 would point to a healthy industrial growth which has been fostered by war conditions. Table V shows the countries of origin of these imports in 1916 to 1917.

TABLE IV. KINDS OF MACHINES WHICH SHOW DECREASED IMPORTATION FROM 1912 TO 1917

Kind of Machinery	1912	1913	1914	1915–16	1916–17
Adding and computing machines	$364,384	$481,501	$313,631	$210,418	$257,365
Churns	90,308	114,557	107,248	93,490	73,932
Gas and oil engines	850,825	936,427	897,314	755,709	539,987
Portable and traction engines	830,731	705,360	293,917	277,877	218,404
Locomotives	2,280,306	2,070,185	1,620,228	534,609	381,976
Ploughs, harrows, etc	687,223	604,244	635,521	613,846	516,141
Other agricultural implements	1,009,088	854,003	720,768	727,878	627,087
Clothes wringers and washing machines	167,417	146,092	98,240	79,927	58,237
Dynamos over 200 hp	245,096	335,891	227,942	64,870	85,042
Mining machinery	469,393	541,096	388,926	412,416	361,211
Motive-power machinery	2,483,686	2,486,490	2,358,126	1,454,587	1,205,817
Printing presses	886,044	940,962	575,381	504,223	254,065
Sewing machines	1,489,679	1,260,073	731,508	1,069,203	1,133,442
Typewriters	533,155	477,973	343,624	381,480	471,394
All other machinery	6,360,082	6,750,668	5,959,049	4,194,198	4,615,773
Total	$18,747,417	$18,705,522	$15,271,423	$11,374,731	$10,799,873

TABLE V. COUNTRIES OF ORIGIN OF IMPORTS GIVEN IN TABLE IV

Kind of Machinery	United Kingdom	Canada	United States	Sweden	All Others
Adding and computing machines	$9,329	$2,394	$236,463	.....	$9,178
Churns	3,562	.....	43,195	$16,561	10,614
Gas and oil engines	225,737	16,600	264,640	30,406	2,604
Portable and traction engines	62,758	.....	155,646	.....	.....
Locomotives	315,018	.....	64,608	.....	2,351
Ploughs, harrows, etc	62,033	268,072	173,472	.....	12,565
Other agricultural implements	72,603	204,296	335,443	4,102	10,643
Clothes wringers and washing machines	13,563	.....	44,237	.....	437
Dynamos over 200 hp.	64,000	.....	21,043	.....	.....
Mining machinery	81,173	1,475	274,685	3,285	594
Motive-power machinery	827,466	13,728	336,826	11,188	16,609
Printing presses	55,576	5,217	188,781	.....	4,492
Sewing machines	536,254	185	583,226	6,205	7,572
Typewriters	16,254	1,231	453,777	.....	131
All other machinery	2,029,511	13,529	2,393,321	96,493	82,920
Total	$4,374,837	$526,727	$5,569,363	$168,240	$160,710

Promising Outlook for American Trade

The United States is, therefore, the leader in the machinery market of Australia according to latest available statistics. Whether this leadership can be maintained will of course depend upon a great many considerations, not the least important of which are closely related to the suggestions made above. The Australian machinery merchant is fully alive to the advantages and good points of American machinery, just as he appreciates most keenly the weakness in our export methods, the brunt of which eventually must be borne by him. The closest attention should be paid to his wishes if we are to encounter a full measure of success.

US ARMY ORDNANCE NEWS

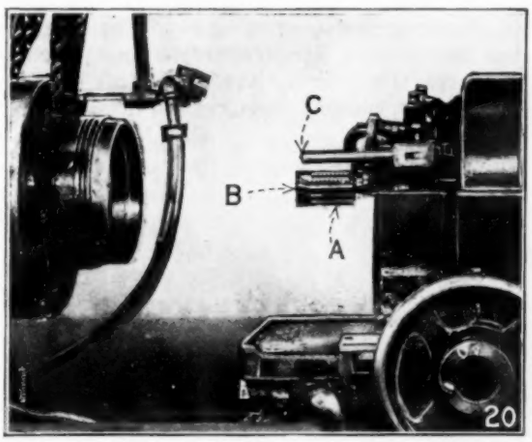
Manufacturing the 9.2-In Howitzer Shell

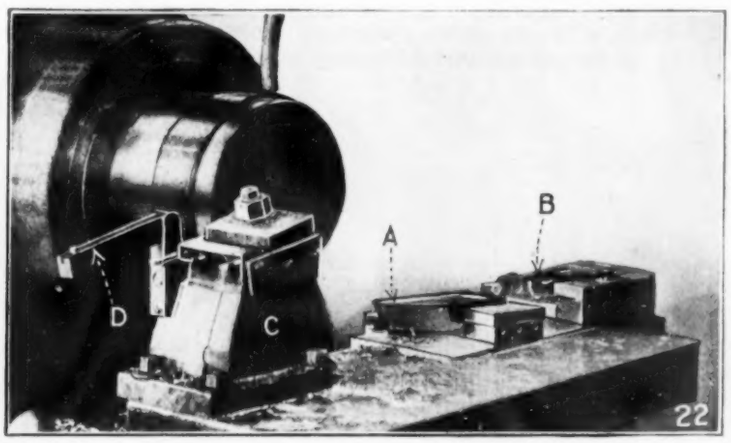
By S. A. HAND.

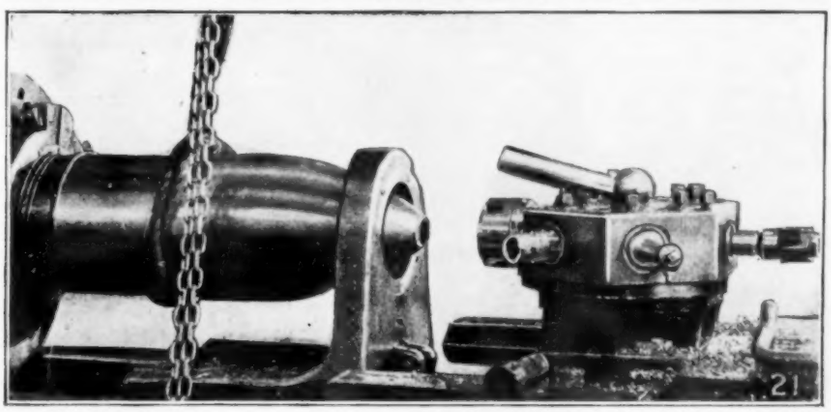
(*Continued from Page* 897, *May* 8 *issue*)

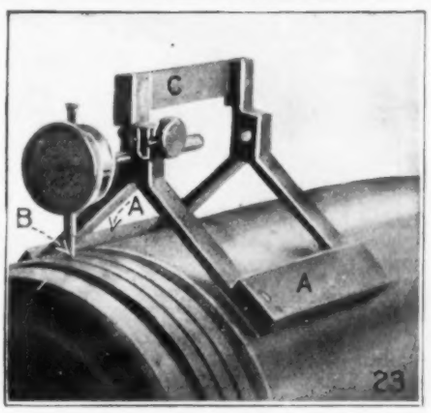
THE thread is milled in a Lees-Bradner thread-milling machine, Fig. 20, the shell being held in a draw-in collet. The hob *A* is of high-speed steel and is without lead, the lead being given to the carriage of the machine by the usual lead screw and change gears. The hob is set to cut the full depth of the thread so that the operation is completed in one revolution of the shell plus a slight overtravel to insure a perfect thread. After completion of the thread the hob is withdrawn from the shell and a milling cutter *B* attached to the outer end of the arbor. This is used to finish the counterbore for the base-plug flange by circular-milling without disturbing the shell in its setting. For this last part of the operation the cutter is positioned for distance by bringing the end of the stop *C* against the shell base and for depth of cut by a stop on the cross-slide. For this part of the operation the lead screw is out of commission and the carriage clamped to the bed of the machine.

The nose must now be faced, countersunk, bored, reamed to size for threading, thread clearance cut and the hole tapped. These operations, Fig. 21, are done









FIGS. 20 TO 23. THREAD MILLING, TURNING AND TESTING

Fig. 20—Milling the thread. Fig. 21—Finishing the nose. Fig. 22—Turning the copper band. Fig. 23—Testing the copper band for concentricity.

ARMY ORDNANCE NEWS

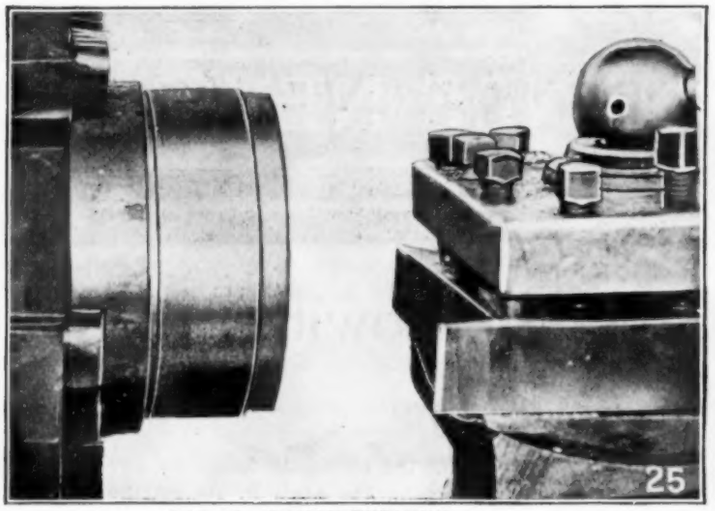


FIG. 25. ROUGH-TURNING

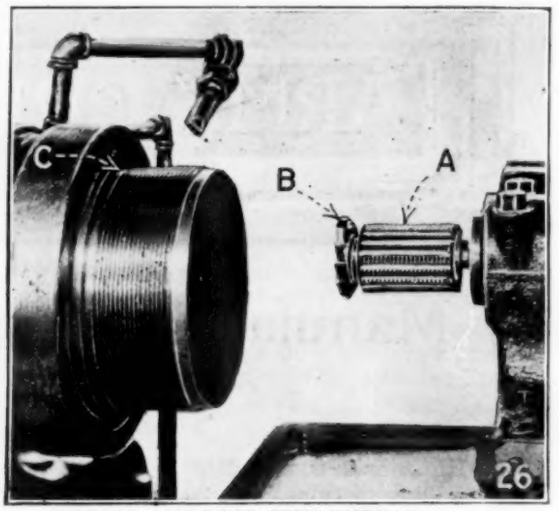


FIG. 26. MILLING THE THREAD

in a 22-in. lathe provided with a hexagon turret on the carriage. The shell is held at the base by a split-ring chuck and supported at the nose by a special steadyrest having a copper ring of the same profile as that of the shell. The operations are such as are used in every-day screw-machine practice and with the exception of cutting the thread clearance, need no further description.

The tool for cutting the thread clearance is single pointed, with the point projecting downward.

In operation the turret-binding lever is slacked off and the turret is raised from its seat by a spring. This allows the tool to clear the bottom of the hole, and while in this position it is fed in beyond the hole and the turret clamped down to its normal position, setting the tool to cut to the proper diameter. The carriage is then fed by hand to the right until a swinging stop on the tool bar (not shown) can be swung clear of the nose. This makes a roughing cut. The feed to traverse the carriage to the left is then thrown in and the spring of the tool makes a finishing cut, when the binding screw is again slacked off and the tool clears the hole by the rising of the turret and is withdrawn without touching the hole.

This arrangement is very simple and obviates the necessity of an auxiliary slide on the turret face.

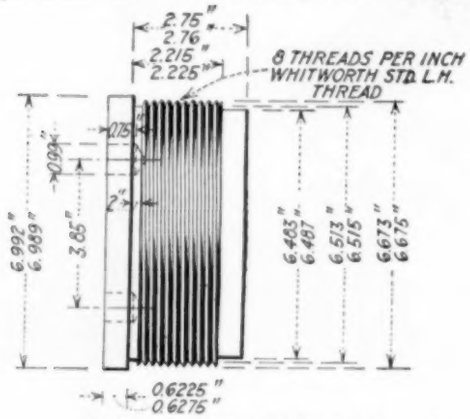
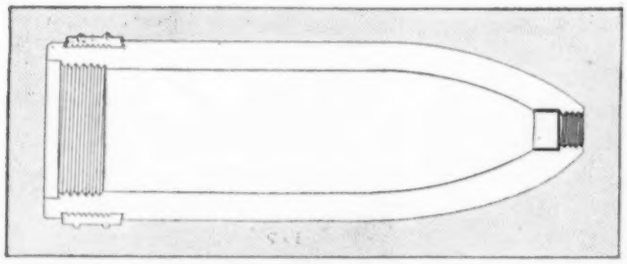


FIG. 24. THE BASE PLUG



TRANSFORMATION FOR OPERATION 512—FINISH NOSE

Machine—Davis 22-in. lathe. Number of operators—One. Work-holding device—Split-ring chuck for base; nose run in special steadyrest. Tool-holding device—Turret on carriage. Cutting tools—High-speed steel. Number of cuts—Four, one counterbore, one ream, one relief, one tap. Cut data—Speed, 58 ft. per minute; feed, 0.021 in. per revolution. Coolant—Mineral lard oil. Gages—Profile, plug, go 1.900 in., No-go, 1.907 in.; plug thread; length of thread. Production, 45 per machine in eight hours.

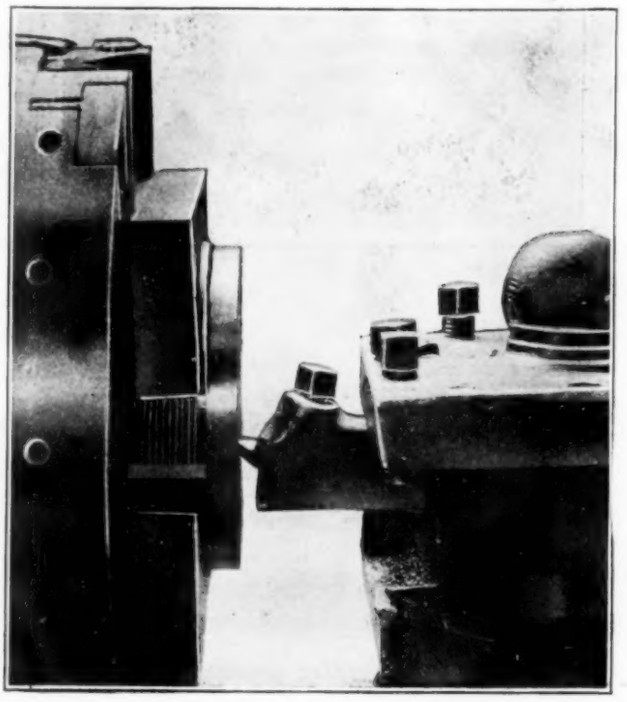
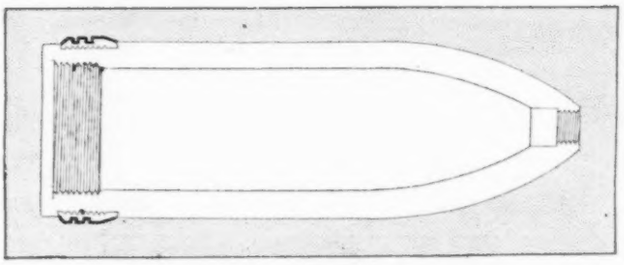


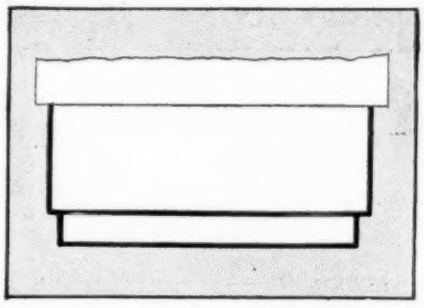
FIG. 27. FINISHING THE FLANGE DIAMETER

ARMY ORDNANCE NEWS



TRANSFORMATION OF OPERATION 515—TURN BAND

Machine—Root & Vandervoort band-turning lathe. Number of operators—One and helper. Work-holding device—Air-operated chuck. Tools—High-speed steel, two trimming tools and one serrating tool in tool block, one roughing and one finishing tool working in slide underneath. Number of cuts—One rough, one finish, one trim and one serrating. Cut data—Speed, 132 ft. per minute; hand feed. Coolant—Soluble oil. Gages—Snap, go, 9.345 in., no-go, 9.335 in. Profile and concentricity. Production—Not definitely known as these machines have just been installed and are as yet an experiment.



TRANSFORMATION FOR OPERATION 540—FACE PILOT, ROUGH-TURN BODY AND PILOT

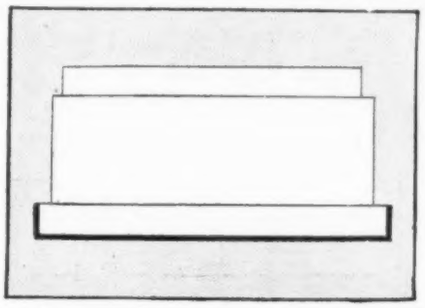
Machine—Davis 22-in. lathe. Number of operators—One. Work-holding device—Lathe chuck. Cutting tools—High-speed steel. Number of cuts—One facing and two turning. Cut data—Speed, 40 ft. per minute; feed, 0.047 in. per revolution. Coolant—None. Gages—Snap, go and no-go for both body and pilot diameters; length for body. Production—38 per machine in eight hours.

The machines now used for turning the copper band are more or less of an experiment in this plant. While the production on the former type of machine used was fair, the concentricity between the shell and the band was not up to the standard.

The machines now in use were made by Root & Vandervoort, and in them the shells are held in an air chuck. The roughing and finishing tools are formed high-speed steel tools and are set tandem on the cross-slide of the carriage at *A* and *B*, Fig. 22. As will be readily seen they make the cut by passing underneath the work. The feed is by hand and is so heavy that it requires the use of a lever between the spokes of the operating handwheel. The space between the two tools is small and the copper chips or shavings choke there to such an extent that a man is stationed behind the machine to clear them away.

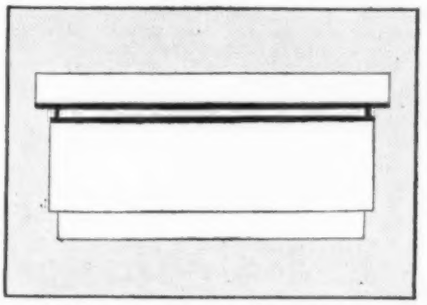
The tool *A* is the roughing tool. The tool *B* finishes the band to diameter, tapers the front edge and cuts the lubricating grooves. The tool block *C* carries a tool on each side to trim the band to width. There is also a pivoted tool *D* shown in the out position. When this tool is swung forward and fed to the work it cuts a number of fine serrations in the tapered part of the band.

Upon completion of the band turning the shell is laid on a bench and the band tested for concentricity with the body by the apparatus shown in Fig. 23. The frame of the device rests on the shell by its feet *A* while the plunger *B* of the dial gage rests on the copper band. The shell is rolled along the bench and the gaging device held in an upright position by holding the bar *C* with the hand. It will readily be seen that any variation from concentricity will be shown by the dial gage. After this test a spliced-rope grommet is put on the base to protect the finished copper band from injury. This grommet is kept in place during subsequent operations until it is necessary to wash the shell prior to varnishing.



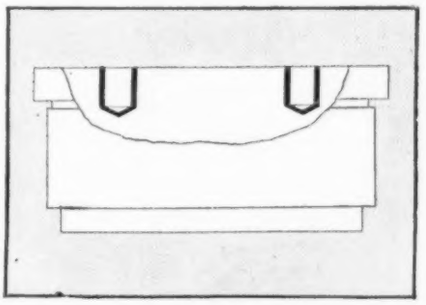
TRANSFORMATION FOR OPERATION 543—ROUGH-TURN AND FACE FLANGE

Machine—Fairbanks-Morse 16-in. lathe. Number of operators—One. Work-holding device—Lathe chuck. Tool-holding device—Square turret on carriage with two tools. Cutting tools—High-speed steel. Number of cuts—Two on face and one on diameter. Cut data—Speed, 82 ft. per minute; hand feed. Coolant—None. Gages—Snap, go, 7.020 in.; no-go, 7.015 for diameter and thickness, 0.680 in. for flange. Production—60 per machine in eight hours.



TRANSFORMATION FOR OPERATION 544—FINISH FLANGE SEAT

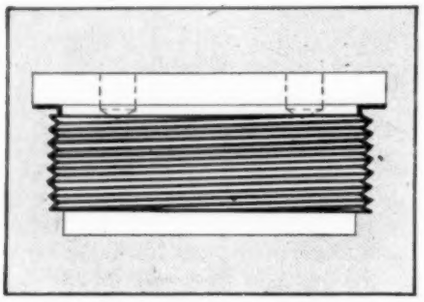
Machine—Warner & Swasey. Work-holding device—Ring chuck. Tool-holding device—Turret on carriage with two tools. Cutting tools—Stellite. Cut data—Speed, 156 ft. per minute; hand feed. Number of cuts—Two. Coolant—None. Production—250 per machine in eight hours.



TRANSFORMATION FOR OPERATION 545—DRILL KEYHOLES

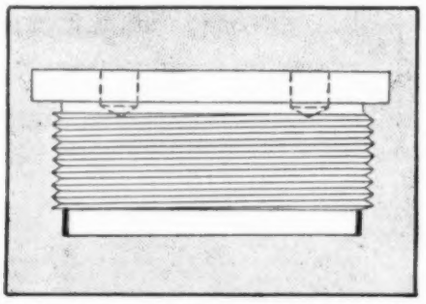
Machine—Upright drilling. Number of operators—One. Cutting tool—$\frac{3}{4}$-in. high-speed drill. Number of cuts—One for each hole. Cut data—Speed, 60 ft. per minute; hand feed. Coolant—None. Special fixture—Jig. Gages—Center to center of holes. Production—350 per machine in eight hours.

ARMY ORDNANCE NEWS



TRANSFORMATION FOR OPERATION 546—MILL THREAD AND CUT CLEARANCE

Machine—Lees-Bradner thread-milling. Number of operators—One. Work-holding device—Draw-in collet. Cutting tools—Threading hob and plain milling cutter (high-speed steel). Number of cuts—One for threading and one for clearance. Cut data—Speed, 89 ft. per minute. Coolant—Mineral lard oil. Gages—Plug thread, go, 6.675 in.; no-go, 6.671 in., thickness, go, 0.63 in.; no-go, 0.61 in. Production—70 per machine in eight hours.



TRANSFORMATION FOR OPERATION 547—FINISH PILOT DIAMETER

Machine—Lodge & Shipley 20-in. lathe. Number of operators—One. Work-holding device—Ring chuck. Cutting tool—Stellite. Number of cuts—One. Cut data—Speed, 145 ft. per minute; hand feed. Coolant—None. Gages—Ring, go, 6.490 in.; no-go, 6.480 in. Production—500 per machine in eight hours.

The shell is now ready for fitting the base plug, and it will be well at this point to consider the manufacture of that member.

The Base Plug

The forgings for the base plugs are of the same composition as the shell forgings, and like the latter are furnished to the manufacturers by the Government. They weigh in the rough about 55 lb.

SEQUENCE OF OPERATIONS

540. Face pilot. Rough-turn body and pilot.
543. Rough-turn and face flange.
544. Finish flange seat.
549. Face flange to thickness.
545. Drill keyholes.
546. Mill thread.
547. Finish pilot diameter.
548. Finish flange diameter.

Fig. 24 is a drawing of the finished base plug and shows all the working dimensions.

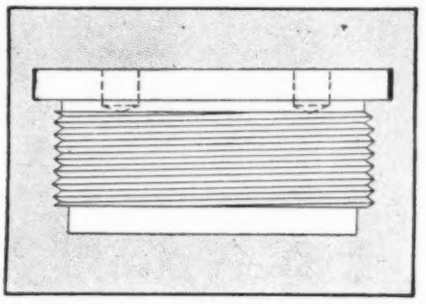
With the exception of drilling the wrench holes, milling the thread and its clearance, the operations on the base plug are all done in lathes of the regular type. The work in the greater part of the operations is held in ordinary lathe chucks and the tools in square turrets on the carriages. High-speed steel is used for roughing, Stellite for finishing and no coolant is used. Fig. 25 illustrates the first lathe operation and is so typical of the ones that follow that a description of them would be monotonous.

The wrench holes are drilled in an upright drilling machine and a jig that slips over the flange is used. The holes are $\frac{3}{4}$ in. in diameter and $\frac{3}{4}$ in. deep.

Milling the Thread

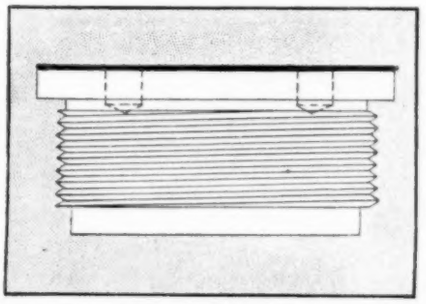
The thread, 8 per inch Whitworth left hand, is milled in a Lees-Bradner thread-milling machine, Fig. 26, and the plug is held by the flange in a draw-in chuck.

The hob *A*, which is high-speed steel, is without lead,



TRANSFORMATION FOR OPERATION 548—FINISH FLANGE DIAMETER

Machine—Lodge & Shipley 20-in. lathe. Number of operators—One. Work-holding device—Chuck gripping work by threads. Cutting tools—Stellite. Number of cuts—One. Cut data—Speed, 147 ft. per minute; hand feed. Coolant—None. Gages—Snap, go, 6.992 in.; no-go, 6.989 in. Production—500 per machine in eight hours.

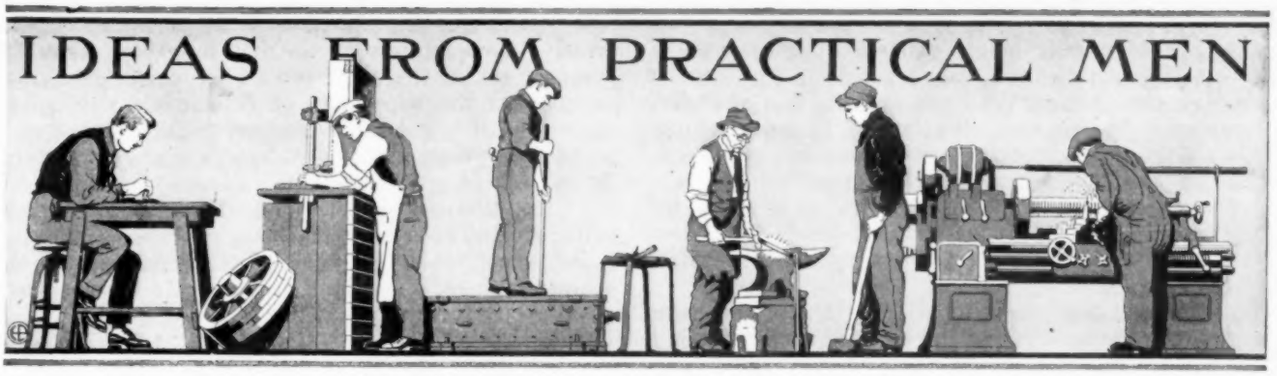


TRANSFORMATION FOR OPERATION 549—FACE FLANGE TO THICKNESS

Machine—Lodge & Shipley 20-in. lathe. Work-holding device—Draw-in collet. Cutting tools—Stellite. Number of cuts—One, or two if necessary. Cut data—Speed, 156 ft. per minute; feed, 0.047 per revolution. Coolant—None. Gages—Thickness, go, 0.63 in.; no-go, 0.61 in. Production—200 per machine in eight hours.

the lead being given by the movement of the carriage through the usual lead screw and change gears. The full depth of the thread is cut at once, and the threading is completed in one revolution of the work plus a slight overtravel to insure a perfect thread. Upon the completion of this operation and before removing the plug from the machine, a milling cutter *B* is attached to the arbor outside of the hob and is used to finish the clearance *C* back of the thread by circular-milling. For this part of the operation the carriage is clamped in position, the feeding mechanism for the thread lead being thrown out of gear.

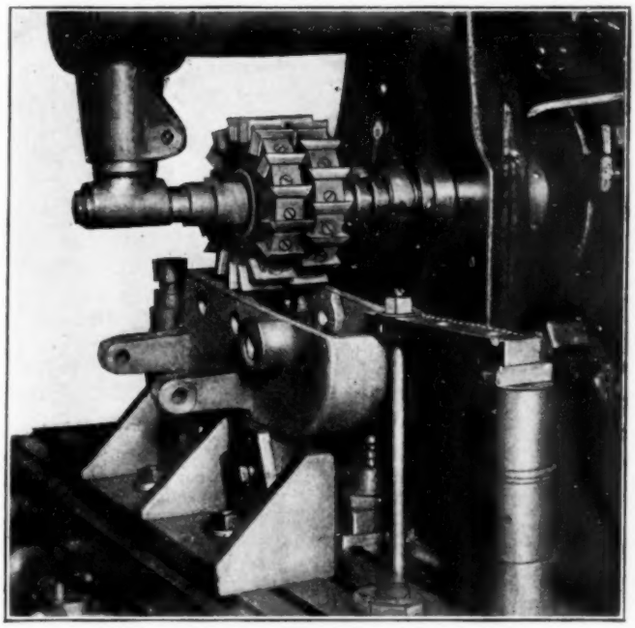
The last operation, Fig. 27, is to finish the diameter of the flange. This, like other operations, is performed in an ordinary engine lathe, the only difference being in the manner of holding the work. To prevent injury to the threaded part, by which the work must be gripped, it is held in a two-jawed chuck having a thread milled in the jaws of the same form and pitch as that on the plug.



Facing Off Inside Bosses

By E. V. Allen

A simple and quick method of facing off inside bosses is shown in the illustration. This work is done in the shop of the Acme Machine Tool Co., Cincinnati, Ohio. The gear-box casting is lined up and clamped to the milling-machine table under the correctly spaced side-



FACING OFF INSIDE BOSSES

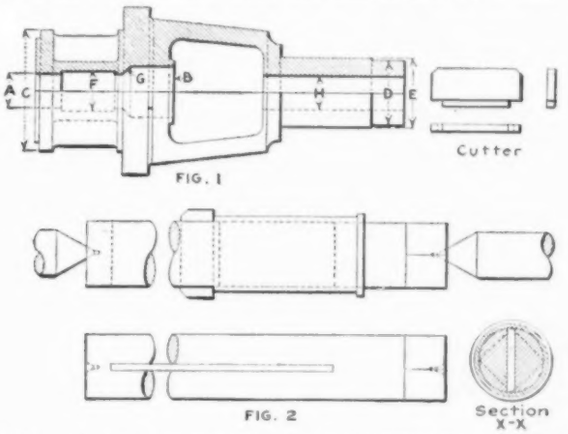
milling cutters on the arbor. The table is then raised and the opposing bosses on the inside of the casting are milled off at once.

Re-boring a Corliss Valve-Bonnet

By A. M. Stiles

Metallic packing when used on worn valve stems of the Corliss type is very likely to give trouble unless the stem is cylindrical and turns perfectly true. Even where the design of the packing provides for lost motion in the stem, better results will be obtained by truing up the latter and bushing the bonnet.

While attaching metallic packing to six triple-expansion pumps in water-works service, the writer observed that only a short bearing was provided at the back of the bonnet at *A*, Fig. 1; also that the face at *B* had not been machined. The design of the bonnet provided for fibrous packing and a short loose bearing at *A* was considered good practice, for it insured an ample supply of steam on the packing to keep it lubricated. Neither was it necessary to face the surface *B*, the gland studs not requiring it, but the adoption of metallic packing necessitated having the bonnet bored and bushed concentric with the diameters *C*, *D* and *E*,



FIGS. 1 AND 2. THE PIECE TO BE REBORED AND THE BORING BAR

for the bearings were badly worn and out of alignment. Diameter *F* was cored.

There were 40 steam and exhaust bonnets to be bored and the bar used is shown in Fig. 2. But one set-up was used and the cuts were taken with the job revolving. Several attempts had been made to enlarge the holes with reamers with extended shanks, but these

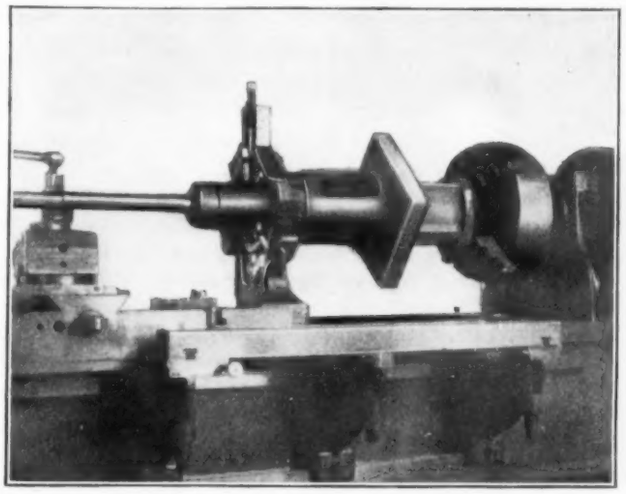


FIG. 3. REBORING A LONG PIECE

invariably followed the worn or cored holes with unsatisfactory results. This type of boring bar is not new and, as usually made, carries but one sleeve of sufficient length to bore ordinary holes. The regular carriage feed is used, and the cutting rate therefore depends on the speed of the lathe. Its adoption for this job required that the sleeve be made up in sections to keep the bar as short as possible.

The cutters were made of flat stock $\frac{5}{16}$ x $1\frac{1}{4}$ in. and finished only at the diameters and bevels as shown. The bar is of machine steel and the sleeves are made of cast iron.

The bonnet was faced at *B*, Fig. 1, for the gland gasket, by passing a cutter through the hand space into the bar and fitting it into the sleeve. The stuffing-box was also trued up in this way and the bevel at *G* faced square for the spring retaining washer. These cutters were too long to pass through the diameter *H*.

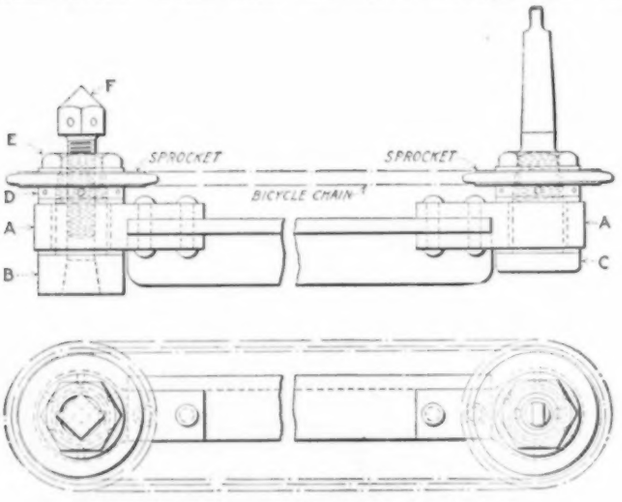
The holes were very smooth, free from taper, in alignment and concentric with the valve chamber, bell crank, and cut-off collar bearings, thus making the fitting of bushings an easy job. The set-up is shown in Fig. 3.

A Simple Corner Drilling Device

By J. Gardner
Gourock, Scotland

The sketch shows a simple corner drilling attachment for use in conjunction with either pneumatic or electric drilling machine. Although this attachment was designed to complete a difficult bit of corner drilling which was beyond the range of the standard corner machines, it has since proved quite a useful tool to have in the shop for drilling in awkward corners.

The body of the attachment consists of a piece of angle iron to both ends of which the pieces *A* are fixed with rivets. Plain holes are bored through both of



DEVICE FOR DRILLING IN A CORNER

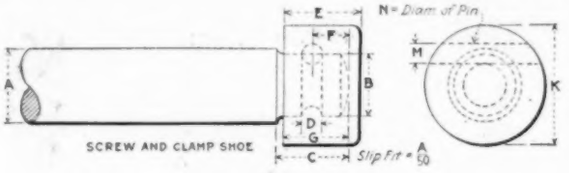
these pieces and gun-metal bushings are driven therein to form bearings for the shanks *B* and *C*. The lower end of *B* has a tapered square hole in it to fit the ends of drills used. A portion of the shank *B* is threaded to receive the circular nut *D*, the latter being provided with holes around its periphery for a tommy-bar. Above the nut *D* the diameter of the shank is reduced slightly and threaded to take another nut *E*. Between nuts *D* and *E* a sprocket wheel is placed and as additional means of securing it, two small feathers are set in it. Apart from serving to clamp the sprocket wheel in place the two nuts are used to adjust for wear. A hole is bored through *B* and threaded to take the center *F* used for feeding the drill into the work. The arrangement of the other end of the device is similar except that the upper end of *C* is made a standard taper to suit the driving machine. The two sprocket wheels are connected by a chain which gives a suitable drive.

[While this device will no doubt serve its purpose satisfactorily, an unguarded chain in the position designated would constitute a very serious menace to the operator's fingers. A chain guard should be considered an essential feature of the device.—Editor.]

Standard Sheet for Clamp Shoes

By C. H. Dengler

How much easier is it when designing jigs or fixtures to have a satisfactory set of standard parts to work with than to have to design practically the same parts every time when working in a place where either the standard data sheets are few or else they have none at all! No doubt many readers like myself have worked in both kinds of plants and found when they possessed a good and reliable set of standards many a big job



A = Diam of Screw
B = Root Diam of Thds

C = A		G = 11/12 A	
D = 4/3 N		K = 5/2 A	
E = 7/6 A		M = 1/2 B	
F = 1/2 A		N = 1/4 A	

	SIZE SCREW	HEAD DIAM	HEAD LENGTH	WIDTH RECESS	SHOE LENGTH	LOCATION	DEPTH	SHOE DIAM	LOCATION	PIN DIAM
No	A	B	C	D	E	F	G	K	M	N
1	3/8 × 16	19/64	3/8	1/8	7/16	3/16	11/32	5/8		3/32
2	7/16 × 14	11/32	7/16	5/32	1/2	7/32	5/16	3/4	11/64	7/64
3	1/2 × 13	13/32	1/2	5/32	10/32	1/4	15/32	27/32	15/64	1/8
4	9/16 × 12	7/16	9/16	3/16	21/32	9/32	1/2	15/16	7/32	9/64
5	5/8 × 11	1/2	5/8	3/16	3/4	5/16	9/16	1 1/16	1/4	5/32
6	11/16 × 10	9/16	11/16	7/32	13/16	11/32	5/8	1 1/8	9/32	11/64
7	3/4 × 10	5/8	3/4	1/4	7/8	3/8	11/16	1 1/4	5/16	3/16
8	7/8 × 9	3/4	7/8	9/32	1	7/16	13/16	1 7/16	3/8	7/32
9	1 × 8	27/32	1	5/16	1 1/16	1/2	29/32	1 5/8	27/64	1/4

TABLE OF STANDARDS FOR CLAMP SHOES

was finished with much time saved both in the drawing office and the toolroom.

With the double result to be gained of a better tool produced at less expense, why is it that so few plants appreciate the benefit of a complete set of standard tool parts as well as standards for the important machines? How many hours have you wasted running out in the shop to know the width of this machine table, the taper on that machine spindle, the length through the spindle, the distance between the shears, and many other dimensions that must be known exactly before a fixture can be fitted to a machine?

Now this data should be furnished by the machine builder if he wants his customers to get full service from his machine. Some manufacturers are most willing to help the users of their machines to adapt them to

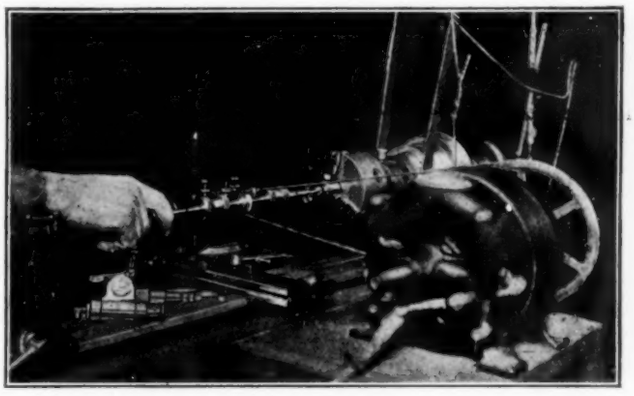
their requirements, while others act as if they were giving away secrets by setting forth the before mentioned sizes.

The sketch shows a table of standards for clamping shoes that has been in constant service since the war started. The table is self-explanatory. The formula for deriving the various sizes is given, as is also a table of screw sizes between ⅜ and 1 in. We generally cyanide the bearing end of the screw to resist wear. The radius on the screw gives us a one-point contact, which allows the shoe to take up any unevenness of the work.

Driving Grinding Attachment of Bench Lathe With Motor

By J. J. McIntyre

The cut shows the means by which we avoid the extra countershaft over a bench lathe used to drive the grinding attachments. A ¼-hp. motor is mounted on a suitable stand and the armature shaft fitted with a grooved driving wheel. This method of mounting provides ready portability so that the motor may be used on any one of several lathes.



DIRECT DRIVE OF GRINDING ATTACHMENT

Reverse Drawing a Shell

By G. R. Smith

A brass shell was to be made in two drawing operations from 0.020-in. sheet brass. It was blanked and cupped from the strip, then redrawn with practically the same tools. The second drawing operation turned the shell completely inside out. No special stock was required, only a single annealing operation between draws which would have been required under any conditions.

In Fig. 1 are shown the tools set up for the first operation of blanking and cupping from strip stock, the blanking operation being done at *A*, which is a tool-steel ring hardened, sunk in the die holder *G* and held in position with fillister-head machine screws. After the disk is blanked from the stock it is drawn over the core ring *B*, which is also tool steel hardened, sunk in *G* and held with fillister-head screws. The radius on the outside of *B* is the shape required in the bottom of the shell from the first draw. The inside radius of *B* is the shape required to permit an easy draw in the second operation. The pressure ring *C* governs pressure on the stock during the draw. Pins *Q* pass through *G* to the steel ring *D* resting on the rubber bumper *E*, which is held in position by the rod *F* screwed into a removable plug *M*. The pressure is controlled by a nut at the bottom of the rubber bumper.

In Fig. 1 *H* is the tool-steel blanking and drawing-ring punch hardened and sunk into the die holder *I* and held in position by fillister-head machine screws. A round stripper plate *J* is fastened to a rod passing through the spring *K* and through the removable plug *L*. Its downward travel is limited by a pin *N*. This stripper forces the drawn shell out of the punch should it tend to stick there after the draw, while the pressure ring *C* acts in the same way should the shell cling to the center core ring *B*.

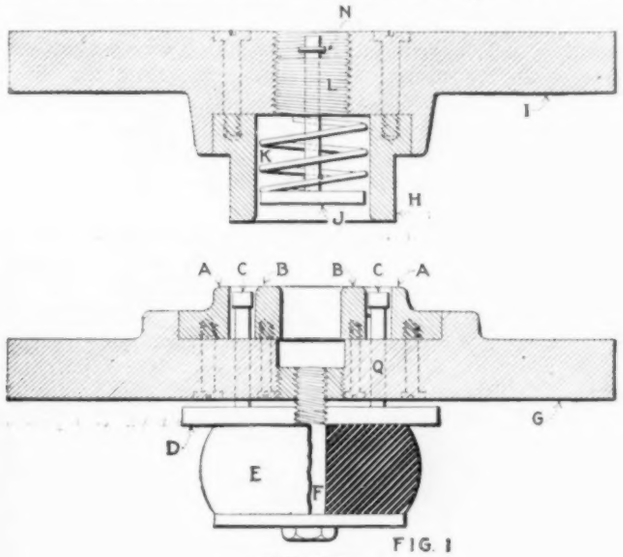


FIG. 1

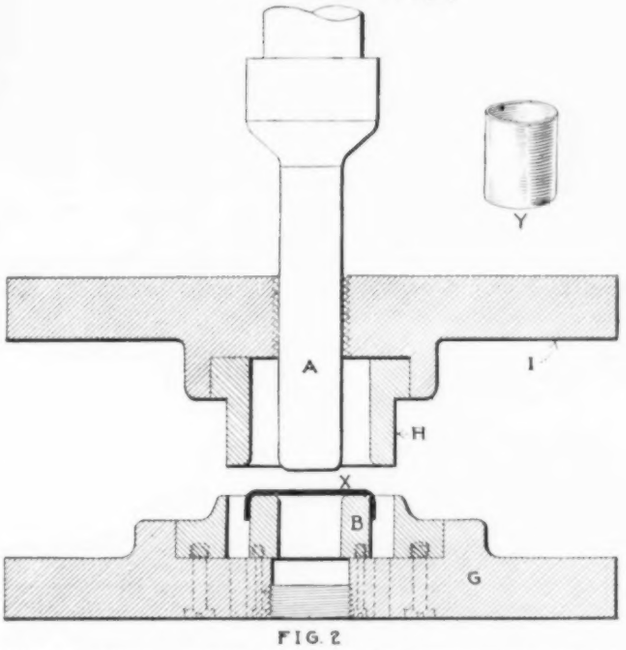


FIG. 2

FIGS. 1 AND 2. FIRST AND SECOND OPERATION TOOLS FOR A BRASS CUP

At *X* the shell is shown as it comes from the die after the first operation. Lard oil is used to lubricate the stock. The present production is from 1200 to 1500 an hour with the operator removing the shell from the die by hand. In shops where compresesd air is used this production could be materially increased.

If these tools are carefully set up and watched oc-

casionally for scratches on the side of the shell and for metal clinging to the radius of the die they will be found to be very satisfactory. Plenty of oil must be used as, in brass drawing, dry stock causes more trouble than anything else. The radius on the punch *H* and the radius on the die ring *B* must be polished off occasionally, and great care must be taken to see that no small particles of emery or grit are left in the die.

Fig. 2 shows the same tools prepared for the second draw. The pin *N* in the end of the stripper rod in the punch, Fig. 1, is removed and the stripper arrangement is completely removed from the punch, then the plug *L*, Fig. 1, is taken out and the punch is ready. In the die the rod *F*, Fig. 1, is removed, the rubber bumper and the plug *M* taken out of the die, together with the pressure ring *C* and riding pins. This prepares the die for the second draw.

In this operation another punch is used, which is simply a tool-steel piece turned up to the required shape and hardened. It is shown at *M*. In Fig. 2 at *X* is shown the first operation shell in position for the second-operation draw. At *Y* the finished shell is shown as it comes from the second draw. The first operation shell is simply slipped back over the core ring *B* where it was first drawn, and as the center ram of the press descends it turns it inside out and pushes it down through the ring *B* and die holder *G* and out. The punch ring *H* holds the shell rigid and in position while the punch *A* is in operation on the second drawing.

These tools were set up in a No. 1½ toggle-action Bliss drawing press. In the second operation the punch holder *I* is left in position after being stripped down, and the steel punch *A* is screwed or pinned to the center ram of the press.

The shell is stripped from the punch in the second drawing operation by the lower edge of the die *B*. When the draw is completed and the punch has forced the shell below this edge the shell expands enough to strip from the punch on the upward stroke.

Thus we are blanking from the strip stock and doing first and second drawing operations on practically the same set of tools.

Milling Pulley Faces

By A. Des Angelis

A machine for milling pulley faces built upon the principle shown on page 528, vol. 49, of the *American Machinist* may be seen in the cut. The machine consists of a horizontal spindle running in bearings in a suitable bracket or pedestal, another horizontal spindle lying at right angles to and considerably below the plane of the first, and means of driving the two at suitable speeds.

MACHINE FOR MILLING PULLEY FACES

The first spindle has no movement other than rotative. It is arranged to receive the bored and faced pulley casting at one end, this casting being held in place by a large washer and retaining nut, while at the other end of the spindle is keyed the large wormwheel which serves to drive it.

The bearings in which the second spindle rotates form part of a carriage that is movable in a direction parallel to the center line of the spindle. This spindle is driven through a large spur gear at the outer end and at the inner end carries a face mill with a single circle of inserted tooth cutters.

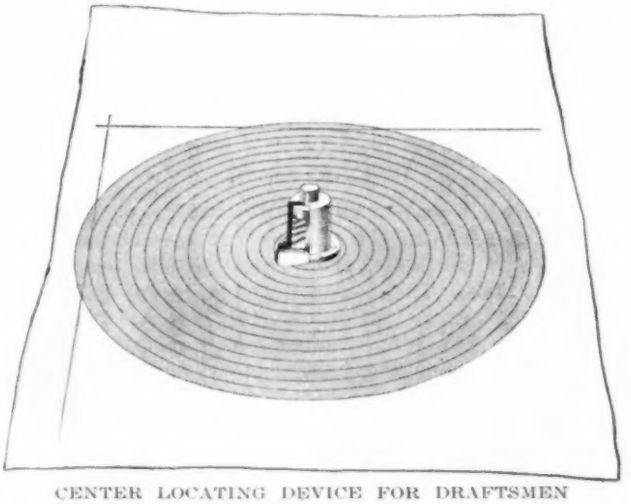
This cutter faces the pulley and the difference in level of the two spindles is so calculated in relation to the diameter of the circle of cutting edges that these latter travel across the pulley face in an arc of large radius leaving the desired crown. A driving shaft turns the cutter spindle by means of a pinion meshing into the large spur gear and it also drives the work spindle by a belted speed-reducing gear and the worm and wormwheel.

It is the sole duty of the young lady shown in the illustration to remove finished pulleys and replace them with castings on ten of these machines. As each machine finishes a pulley in one revolution of its work spindle, the work, while it does not overtax her strength, leaves her very little time for reflection.

Center-Locating Device

By Robert Liebrich

A handy device for draftmen's use by which it is easy to locate the center of tangent circles, is shown in the sketch. It consists of a circular disk of transparent celluloid about $\frac{1}{16}$ in. thick, large enough in diameter for the largest circle which one may wish to use. Any



CENTER LOCATING DEVICE FOR DRAFTSMEN

graduation desired can be made with a pair of sharp dividers, the resultant lines being filled with ink. A plunger with a needle point and spring is fitted into a tube riveted to the center of the celluloid disk. The sketch shows the device set on a piece of paper with the outer lines tangent to the right angle lines on the paper beneath. By pressing on the plunger a center is provided for the point of your compass. This is a simple device, but saves a great deal of time where there is much of this line of work on hand.

Hiring In and Hiring Out

BY ROY A. MONTAGUE

JUST before the armistice was signed directing a cessation of hostilities between the warring nations of the world the necessity of engaging the services of additional detailers and tracers arose in the factory where the writer has charge. Accordingly there was placed the following advertisement in several newspapers circulating in the city, where the plant is located:

> WANTED—Mechanical draftsman; first-class detailer and tracer, at least six years' experience. Shopman preferred. Salary, $20 to $25 weekly. Bring small sample of work. THE SO-AND-SO MANUFACTURING CO.

The response was very feeble, and what few applicants there were seemed to be mostly youngsters with an exaggerated idea of their own value and who calmly proposed that we pay them $25 a week while teaching them the rudiments of mechanical drawing.

Much as I deplored the necessity of blighting their young lives, and indeed much as I needed help in the drafting room, I did not feel justified in placing the firm under obligations to them by accepting their altruistic offers, and in consequence I later suffered the displeasure of several irate mothers who took me severely to task for not recognizing the exceptional ability of their precocious offsprings.

Times, however, have changed since then, and later a single insertion of the same advertisement brought immediate response from about 75 applicants ranging in character all the way from unwashed and more or less untutored exponents of the Bolshevik element to courteous and capable ex-chief draftsmen—this notwithstanding the concise and unmistakable terms of the notice.

It is amusing, though somewhat discouraging, to note the dominant idea of the former that "the world owes them a living," and apparently a good one, too, for they openly and somewhat violently denounced my refusal to increase the amount stipulated in the advertisement, calling the rate offered "a starvation wage" and declaring that the lowest thinkable rate for the kind of man I wanted was $32 a week.

Two of the number called with the express intention of having a good look at me and giving me (presumably without charge) a piece of their minds, but they were sickly looking individuals who apparently possessed little enough of that commodity for their own use to say nothing of passing any of it on.

In sharp contrast to the host of human mediocrity there stood out a number of capable, intelligent men who were a credit to their profession. I was sorry my requirements were so small, as I would have liked to hire them all. These men were for the most part ex-soldiers just released from camp or troopship, and their courteous and respectful demeanor set them apart from the motley civilian crowd whose sullen mood and slouchy manners were anything but an asset.

The army men had complied with all the specifications of the advertisement, had brought samples of their work, and several had their tools with them ready to demonstrate their ability. None of them was without money, another point in which they were in marked contrast to the civilians, every mother's son of whom complained of being broke despite the fact that the preceding four years has been a period of unparalleled prosperity.

One of the ex-soldiers had written to me asking permission to call after 5 o'clock, and this had decided me in his favor. A busy chief never leaves his desk strictly on the hour anyway, and after that time he can give a man his undivided attention for as long as may be necessary, while earlier in the day there are endless interruptions to distract his mind. Further, a logical deduction is that if a man does not wish to cheat his present employer out of a half-day's time he will be equally considerate of his new employer.

Another had sent a written application which I had noted for its brief and matter-of-fact statements, but had not at that time acted upon owing to the numerous mail and personal applications. This man, however, sent a well-timed and well-written follow-up letter which induced me to investigate his record and later to engage him.

When I questioned him about his follow-up system he admitted that he had first written a long letter setting forth his qualifications in detail, but, trying to put himself in my place, he decided that the letter was altogether too long to receive fair consideration, so he conceived the idea of sending it in four installments, dated three days apart, putting all absolutely essential points into the first letter and using the following letters to emphasize details.

Obviously a man smart enough to think up a scheme like that is smart enough to think up other things, and among them may be some that make for dollars and cents in the drafting room. He has since given other evidence of clear thinking and I believe I have made no mistake in hiring him.

The third man had a subtler method. He was on the spot early in the morning watching the shopmen going in to work, figuring that he would know one or more of them. Finding this to be so he buttonholed his friend and elicited from him such information concerning the work, the bosses and his chances as he desired, and fixed it with friend workman to speak to the man higher up.

This scheme worked fine, for later my employer told

Reminiscences by the Old Man

Being a series of reminiscences by the Old Man showing how the fellow on the outside looks to the fellow on the inside and vice versa when they face each other across the office railing. He tells some of the ways in which men go about getting a job and also elucidates some of the reasons why they do or do not get them.

me that "Jim" had a friend who wanted a job; that Jim was a good fellow, and if the friend was all right it might not be a bad idea to engage him. That is the way one man got a job and he is making good. Even now when we know how he did it we bear him no malice.

This concludes my hiring experience with uncivil civilians and civil soldiers, and having brought out my point I will sidestep a little and relate some of my experiences when I was on the other side of the railing.

Outside, Looking In

Some of the before-mentioned soldier applicants had made the not unusual offer to work a week or two on approval, and while this for some reason that I am unable to analyze does not seem to appeal to the average red-blooded employer it serves to remind me of the time when I worked it myself on a wealthy Scot who was the owner of a large plant.

When I had succeeded in getting into his presence and had submitted proof of my fitness for the job he told me that he wanted a practical man; he would not have an M. E. around the place. I knew that there had been three engineers (successively) on the job, two of them of the deadly species known as efficiency engineers, and that each had left in his wake some thousands of dollars in wreckage and junk, therefore I humbled myself to the extent of offering to make good in record time or no pay.

His comment was that the offer was not good enough—he would not be any better off for owing me a few hundred dollars in exchange for some more wasted labor and material.

I wanted that job badly for other reasons than its intrinsic worth; it was to be a stepping stone to another and bigger job that I then had in mind. I took a check book from my pocket and without a word of explanation wrote a check for $500 in favor of Old Scotch, who watched me without moving so much as a muscle of his face.

He seemed to grasp the idea, reached out his hand for the check which, after scrutinizing closely he handed to the treasurer, grabbed his hat and cane and bade me follow him out through endless offices, corridors and departments to the basement of the factory where a gang boss and crew of workmen were gathered about a machine.

Symptoms of uneasiness were visible on the faces of the gang when the "old man" walked in, but he came right to business, ordered the men to remove the upper portion of the machine which had evidently been built on, and assisted them in the process of dismantling and taking it away, using language more or less appropriate to the job and freely expressing his opinion of engineers in general and particularly the one who designed that obnoxious machine.

Inferring that what remained of the machine was to be my trial job I took off my coat and got busy, and when Old Scotch got back from stowing the discarded part in a dark corner of the cellar he explained in a not unfriendly way what was wanted and told me to go to it. He then left me to my own fate.

I soon had all the necessary data and when I left for home that night I had no fear for my $500. I got the check back in my first pay envelope, but I never was able to make any headway in the good graces of Old Scotch. He never commented upon the fact that I had got his machine to work satisfactorily within a very short time. I had the freedom of the plant, was trusted with responsible assignments, and Old Scotch was painfully civil and polite whenever he could not help meeting me, but he studiously avoided me whenever possible and I felt that he never forgave me for disproving his pet theory that engineers were no good.

Another early boss of mine judged his men entirely by their physiognomy. A broad, high forehead and ample-sized nose were his requirements for a designer, and as he strictly adhered to his formula the 12 designers looked like a family of brothers, or at least first cousins. A certain type of face broad in the region of the chin and narrower at the top was supposed to indicate that its possessor was capable of doing good repetitive work without being entirely devoid of intelligence, and this was the face prescribed for the tracer and detailer. He never advanced these poor unfortunates to a better class of work though he did occasionally raise their pay.

Foremen and executives had to have the "hatchet" face with prominent chin, and for every job, big or little, around that plant some particular type of face was prescribed. In some cases this boss went the limit and seriously contended that it was advantageous in a woman clerk to have a tendency toward chronic sore throat as she would talk less and be less likely to muss up the pages of her ledgers with chewing gum.

A Successful Employer

With all his superpsychology this boss was a successful employer and still wields absolute power over his organization. Our opinion as to his personal ability was quite definite and not at all complimentary, but he surely had the knack of picking men who could do the things he wanted done.

Still another boss had a remarkable gift for picking the wrong men. Assurance and a little not too subtle flattery would go a long way in landing a job, while a flashy, gaudy attire unquestionably commanded his attention. His employees of course knew this and unblushingly worked upon his weakness to land themselves in fat positions.

One morning shortly after returning from an extended absence in the South I got a telephone message to report for work at a Jersey City factory. It was a temporary rush job, with salary, hours and everything very definitely arranged. The boss gave me the once over and then the twice. I evidently passed muster, for he immediately took me into the works, gave me clear, concise instructions as to what was to be done and told me pointedly that he must have the work in eight days. If I could not do it say so now or forever hold my peace. There would be extra pay for each day ahead of time.

Although he changed his instructions every day I managed to get the work out on time and was right away assigned to another rush job. At the end of the fourth week I was called to the office and confronted with an iron-bound, rock-ribbed contract covering a period of years and containing the usual clauses con-

cerning patent and secret-process rights, etc. Nothing was forgotten, but unfortunately I had accepted and signed up for another position the night before.

Presenting such a contract after having offered "strictly temporary" employment, with emphasis on the "strictly," made me somewhat sore, as it kept me unnecessarily looking for other work; but it was too late now, as I was already pledged to the other place.

When my employer heard my decision he tore up the contract and bade me good day. He made no remark, but I knew that he felt aggrieved, and when in later years I again applied to him for employment he did not take the trouble to reply to my letter. I found out that he had me classified in his index as unsteady.

Just before the war, having been out of work for a considerable period, I applied for a job with a rather unimportant concern, and during my examination the chief made inquiry as to my religious antecedents. I was considerably surprised and sparred for time to learn his own predilections in order to admit myself to the same fold. I do not consider this to be unjustifiable. If your employer knows no better than to base his estimate of your ability upon your religious convictions, by all means humbug him if you can.

Pipe Dreams of a Tramp Machinist
Why the Scales Didn't Work

By Glenn Quharity

It was near the middle of a strenuous summer in which everybody had been working and worrying a little beyond the point of human endurance to get out production, but the need was urgent and workers were scarce.

The Brookdell Co., a medium-sized manufacturing plant located "somewhere in America" had for many years been in the habit of taking a week off at this time of the year while Mr. Williams, the superintendent, and Tom Jones, the general master-mechanic, with the aid of a few trusty helpers would occupy a portion of this rest period in taking inventory after the manner of our fathers since shops first came into being.

They "took inventory" at this time, not because Mr. Williams did not know about the perpetual inventory system, but because he had long since discovered what many advocates of that system overlook; that it is necessary wherever the perpetual inventory system is in operation to take an ordinary inventory every now and then to find out what is the matter with the perpetual one.

This year it was different. With a shop running night and day to get out material that an impatient Government official was trying to get cased up and started on its way to France a little bit faster than it was being produced, it would not look well to loaf a whole week out of respect for even so time-honored a custom as an annual inventory, so Mr. Williams and Tom, already overburdened with their regular work, were trying at the end of this particular July to take the inventory without stopping the wheels of industry, doing the work with the aid of only such men as could be secured without taking them off a manufacturing operation.

This is how Peter Brown came to be in charge of the weighing of raw stock in the stock-receiving department. Peter's regular job was sweeping floors and "ileing" the shafting, but as the shop was running overtime and Peter was getting old, he had been given two husky assistants to do the actual sweeping and oiling while he "bossed the job." As the assistants could do their work to better advantage when Peter bossed them from a distance, it thus came about that Peter was weighing stock all alone and working quite hard for him.

Along about 11 o'clock one morning as Mr. Williams was crossing the yard, he saw Peter beckoning wildly from the door of the stock shed. Going over to him he was met by the information delivered in a lugubrious voice that "the domd scales is bruk." He went inside and found that Peter had finished weighing up

the bar stock and had wrestled a small keg of castings onto the platform of the scale. There didn't seem to be anything the matter; Mr. Williams jiggled the scale beam up and down with his finger and stepped on the platform, the scales responding readily enough, so he told Peter to go ahead and weigh up the castings.

Peter's back was tired. He started to move the counterpoise along the scale beam, and to avoid having to bend over, he sat down on the keg. After putting another 100-lb. weight on the pan and moving the counterpoise along some more, the scale came to balance. Peter leaned forward, one forearm resting on his knee, to peer at the graduations and the beam came down with a bang. He hitched the counterpoise along toward the fulcrum a little at a time, gradually bringing more weight upon his knee, and finally in his excitement rising to his feet in a stooping posture.

It was now necessary to remove the 100-lb. weight he had just added, and he gave up in disgust. "That's jist th' way th' dom thing's been actin' f'r an hour," he said. "Swelpmegawd, Mr. Williams, I never seen nothin' like it before. 'S'long's I was aweighin' thim bars she was all right but jist the minit I started weighin' that kag she begun actin' crazy. I recken I must'v'e bruk her putting th' kag on."

"Step round in front of the scale and try," said Mr. Williams. Peter stepped and tried. He had no trouble in balancing the scale. Another keg was placed on the platform and still no trouble.

"Let me tell you something, Peter," said Mr. Williams solemnly, "whenever you weigh kegs, always stand on that side of the scale. You may be able to weigh bars from this side, but not kegs."

"I never supposed th' dom things was that sensitive," said Peter wearily.

EDITORIAL

The Need of Training Workers—Now

THE emergencies thrust upon us by the necessity for war production developed possibilities in rapid training which surprised even its advocates. The cessation of the demand, however, followed by the closing of many strictly war activities, stopped the work of the training schools in most cases, and left us almost where we were before.

No careful observer can, however, fail to be impressed with the ever-present need of trained men and women for all our mechanical industries. This need is sure to be more insistent as the months go on and we come into active competition with the greatly increased production of shops in foreign countries.

The training of workers for the machine industries is more important than ever before. And now that we have seen what can be done, even in a very short space of time, we must not let our efforts lag or fail to carry on the good work. It is of course true that more men are available than was the case six months ago and there is also a large body of more or less skilled women workers who have gone out of the shop since the armistice. But anyone who tries to get even a few skilled men often has difficulty in finding them.

With several thousand men reported as unemployed in a certain manufacturing city, the superintendent of a large plant had great difficulty recently in finding 20 men sufficiently trained for various departments of his shop. Common labor was plentiful, but a good lathe hand and a number of similar men were almost impossible to find.

Even if we did not expect to have greatly increased business in the near future it would be the height of wisdom to train what workers we have to a state of higher efficiency, to "up-grade" them, as the modern term describes the process of making them more efficient. Even without increasing our plants we can add to their product by a careful training of the workers in improved methods. And by training the most capable to teach others, we have the nucleus for a largely increased force when the necessity arises.

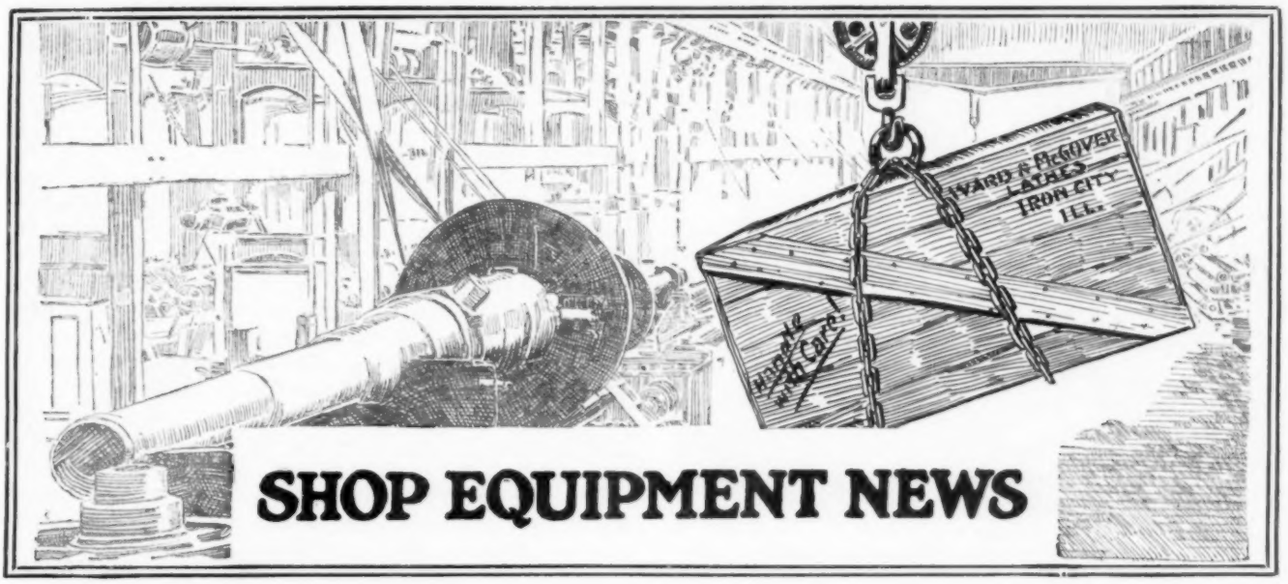
Going beyond this, we have the great possibility of training a certain percentage of the unemployed so as to make them more valuable to industry when the demand comes and also to increase their opportunity for obtaining early employment. It would not be difficult for the business men of a city like Buffalo to finance a method of giving a few weeks' training to several thousand workers. The expense would be little in comparison to the return when these workers could be absorbed into direct production. And the very fact of training them would, itself, have a good effect upon business.

If anyone doubts the necessity of training workers, or feels that we are likely to have a large surplus for months to come, he has but to consider a few of the facts which stare us in the face. It is reported on good authority that there are several million foreign-born workers who are waiting for the opportunity to return to their native land. The State Department is confronted with the issuing of passports in enormous quantities and there is no legal or equitable way to prevent them from going as soon as transportation is available.

These foreign-born workers realize better than many of us that there is a vast amount of work to be done in their devastated countries and that labor is sure to be very scarce. With 15 million workers removed from industry by death or disability as a result of the war, out of an estimated total of not over 75 million before the war, we are faced with the problem of doing the greatly increased work of the world with 20 per cent. fewer workers than before. That we must supply a good portion of the material of reconstruction goes without saying, and yet we are facing an exodus of several millions of workers from our midst.

They have a perfect right to go, and the only alternative is to so train our remaining workers as to enable them to be vastly more productive, and to prepare to again call the army of women workers into the shops when the necessity arises. Many of these are already trained or have the foundation which will make further training easy and rapid. Many shops are retaining a good nucleus of women, both on account of the good work they are doing and the fact that it will make it easier to expand the force when it becomes necessary.

The main consideration at the present time, however, is to pay close attention to the problem of training the men and women we already have, as previously suggested. The experience of such concerns as the Packard Motor Co., the Norton Grinding Co., the New Britain Machine Co., the Yale & Towne Manufacturing Co. and others leaves no doubt as to the advantages of careful training and its effects on production. There is no time like the present. Do not wait until the great demand is here but prepare for it just as you are doing in the sales end of your business; for without economical production and plenty of it, the sales department will not be able to bring success to the enterprise nor to produce the dividends which are so pleasant to contemplate. A little investment in training now will add greatly to the dividends of next year.



SHOP EQUIPMENT NEWS

Multiplex Combination Machine Tool

A machine tool that combines a planing machine, a lathe, a horizontal boring mill, a vertical boring mill, a milling machine, a drilling machine and a slotting machine has recently been placed on the market by the Multiplex Tool Co., Inc., 76 South 8th St., Brooklyn, N. Y. The changes from one type of a machine to another can be quickly made, and it is stated that the machine could handle all operations necessary to reproduce itself except for finishing the bed casting. The machine is primarily intended for repair work in stationary engine rooms, on shipboard, in garages, shipbuilding and repair plants, machine shops, mines, etc.

Fig. 1 shows the machine arranged as a planing machine. In this rôle it performs its functions in a similar manner to most machines of this character, being operated from the right side. A locking device is provided so that the feed for the table will not be accidentally thrown in while other operations are being carried on, and a clamping device is also provided for clamping the table securely to the bed while operations of other

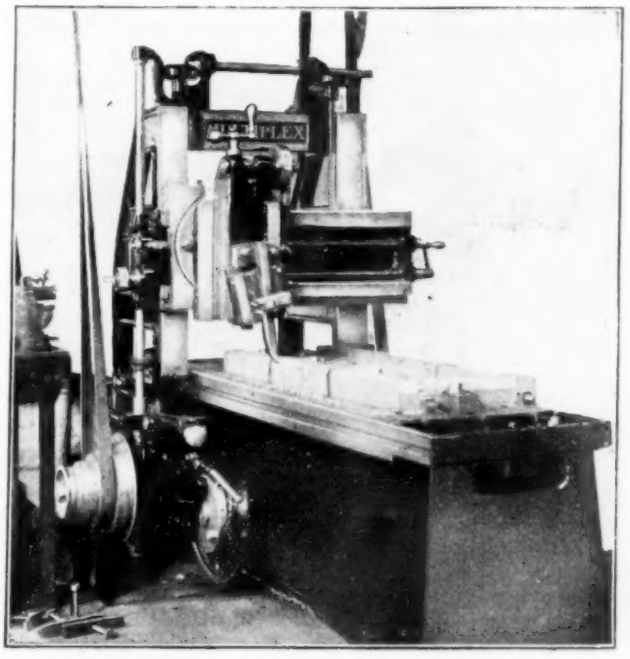


FIG. 1. COMBINATION MACHINE TOOL SET-UP FOR A PLANING OPERATION

Length of table, 5 ft. 8 in.; length of bed, 8 ft. 2 in.; height over-all, 5 ft. 7 in.; width over-all, 5 ft.; planing capacity, 20 by 20 in. by 5 ft.; turning capacity, 14-in. swing, 44 in. between centers, arranged for thread cutting and taper turning, index head arranged in headstock; horizontal boring, 2-in. bar, 24-in. feed; rotary table, power or hand driven 20 in. in diameter and adjustable to swing 96 in.; spindle speeds, 16 to 350 r.p.m.; slotting, 3½-in. stroke which may be increased by making use of the vertical adjustment of the toolhead; drilling can be accomplished at any angle; shipping weight complete, 3500 lb.; floor space required for operation, 4 x 10 x 7 ft.

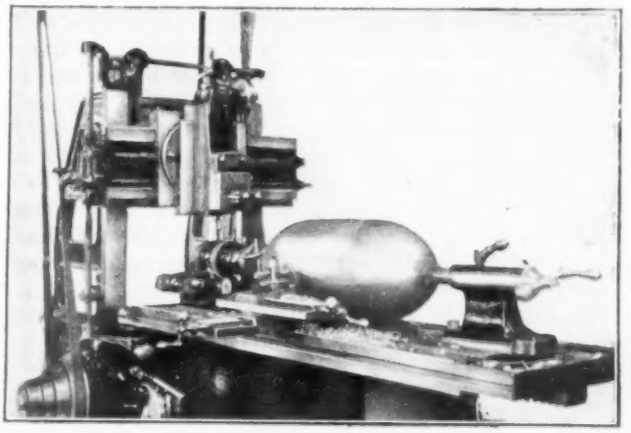


FIG. 2. THE MACHINE IN USE AS A LATHE

character than planing are being performed. The crossrail can be securely clamped to the uprights, the up and down motion being accomplished by hand. It should be stated that this motion and the up and down feed for the toolhead are the only motions on the machine that cannot be power driven. All slides are provided with locking devices for holding them securely against movement when this feature is desired.

Fig. 2 shows the machine performing a lathe operation. The headstock and tailstock have tongues on the base which slide in the center T-slot of the table, while the rest is also tongued and slides in the T-slot on either side. The spindle is driven by means of a bevel gear secured on a taper arbor placed in the drilling spindle and is provided with a complete set of change gears for

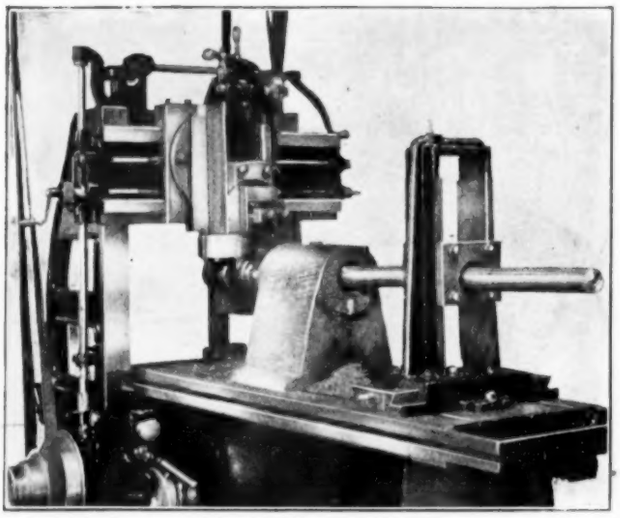


FIG. 3. USING THE HORIZONTAL BORING ATTACHMENT

thread cutting. Motion is transmitted from the gears to the slide through a telescopic shaft equipped with universal joints. The toolpost has a considerable travel on the slide, but in case greater travel is necessary the whole slide assembly can be slid along the top of the table. The slide rest is graduated in order that taper turning may be accomplished. The headstock is also arranged with an index head for milling work carried between centers.

In Fig. 3 the machine is shown in use as a horizontal boring machine. For this type of work a horizontal head is secured to the toolhead, this serving as a bearing for the horizontal boring bar, which is driven by a pair of bevel gears from the drilling spindle in the toolhead. A rest is furnished to support the outer end of the boring bar, and this is adjustable in three directions, longitudinally, crosswise of the table, and vertically. Both the table and toolhead have continuous power feed and automatic stops. It should be stated that this horizontal boring head turns completely around and where it is desired to handle work too large to be mounted on the table, the boring bar can be placed at an angle to the table, and the work mounted on the floor beside the machine.

Fig. 4 shows the machine with a milling cutter mounted in the drilling or milling spindle. This spindle can be driven in either direction as desired, and has either hand or bar feed in a horizontal direction, the vertical feed being by hand. This illustration also shows the rotary table in place. This is turned by hand or by power as desired. When boring work is done the tool is held in the clapper box, or if desired the work can be done with a milling cutter, as shown in the illustration. The rotary table can be placed at any position on the planer table and it will be seen that when placed on the end farthest from toolhead, work of considerable diameter can be handled. The drilling or milling spindle has a No. 10 B. & S. taper hole.

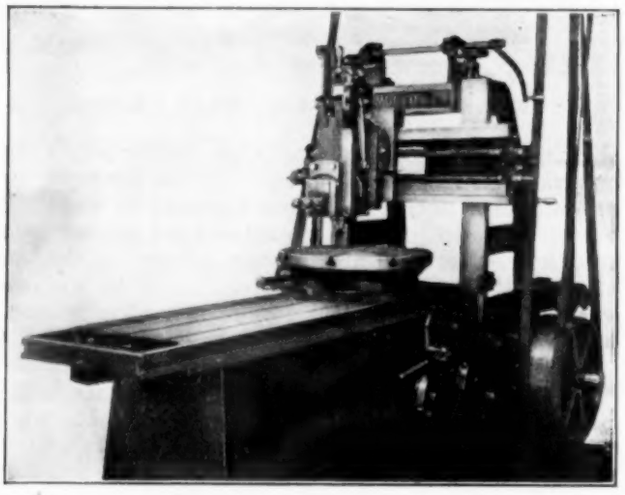


FIG. 4. THE MILLING, BORING AND SLOTTING ATTACHMENTS

Fig. 4 also shows the slotting attachment that is mounted on the side of the toolhead. This slotting attachment has an adjustable stroke up to 3½ in. but greater lengths than this can be machined by taking advantage of the vertical feed of the toolhead.

The spindle of the drilling or milling head is hollow so that arbors can be held in place by means of a draw rod and that the head can be set to an angle so that holes can be drilled or milled at any angle desired.

A particular feature claimed for the machine is that where a piece of work requires a number of operations for completion these can be carried out on the same machine by simply changing the attachment, saving considerable time that would usually be occupied in setting up the piece on various machines.

Greenfield Receding Pipe Threaders

The Greenfield Tap and Die Corporation, Greenfield, Mass., has recently placed on the market the receding pipe-threading device shown in the illustrations; Fig. 1 showing the plain receding threader, while Fig. 2 shows the same device except equipped with a ratchet

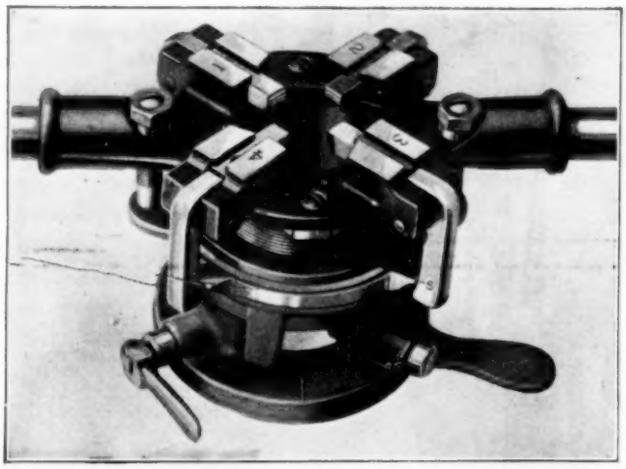


FIG. 1. GREENFIELD RECEDING PIPE THREADER

mechanism for use in close places. In operation the tool is screwed onto the pipe until a thread of the desired length has been cut, after which the threader may be pulled straight off. By releasing the lead screw, lifting the head and resetting the trigger the chasers are again pushed in to the proper point, and the device is ready to start another thread.

One of the advantages is that none but the actual cutting teeth follow around the threads. The chasers are narrow and travel along the pipe parallel to the thread they are cutting and not parallel to the axis of the pipe. The chasers are interchangeable and made

in such a way that it is possible to replace a single one in case of breakage. At the beginning of the threading operation, the chasers cut a full depth of thread, but as the work progresses the levers which support them gradually change position, permitting them to recede until they are finally backed completely away from the pipe, when the threader can be pulled straight off, avoiding lost time in unscrewing. A single turn of

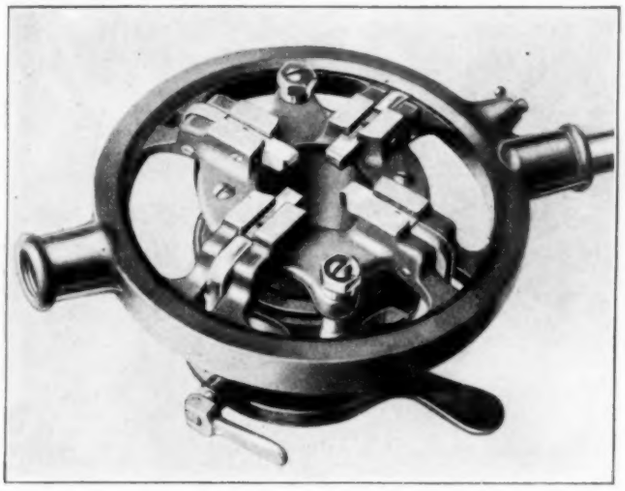


FIG. 2. PIPE THREADER WITH RATCHET ATTACHMENT

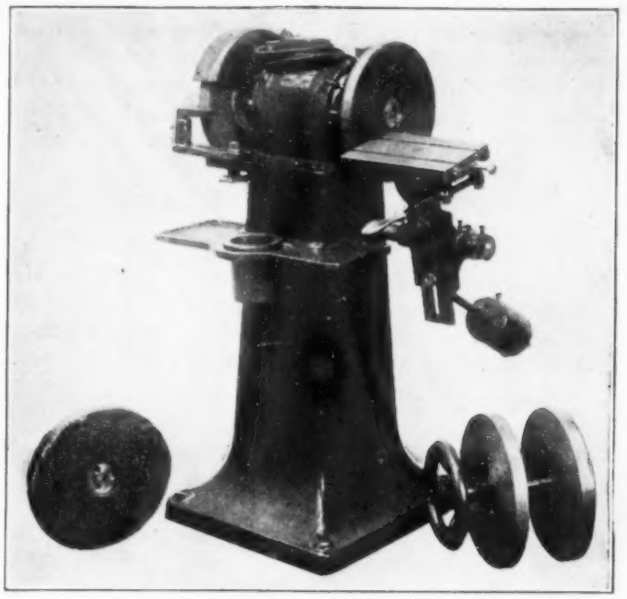
either of three conveniently placed lugs disengages the lead screw so that the head may be pulled back to the original position and reset at that point.

A three-jawed universal chuck guide is provided and after the jaws are tightened against the pipe, one turn of a grip screw working inside of the chuck completes the tightening. The jaws are wide enough to take in a coupling of the largest pipe size that comes within range of the tool. Adjustment may also be made for cutting shallow or deep threads, such adjustment being easily made by changing the setting of the locknut and adjusting rods that project through the sides of the threader. The lead nut is made in three segments which clean themselves, so that no chips can gather on the lead screw. Both the lead screw and nut can be replaced without returning the tool to the factory. The threader is regularly furnished with one set of narrow chasers for each pipe size, Briggs standard right-hand threads being furnished unless otherwise specified. Chasers can also be furnished for cutting British standard threads.

The ratchet receder shown in Fig. 2 has been provided to allow threading operations in trenches, near walls or other places where the amount of space is limited. The only difference from the preceding tool is the ratchet mechanism. The head is so made that the pulling strain of the handle comes directly back of and in line of the chasers in order to minimize the trouble caused by twisting strains. When used with the ratchet mechanism one of the handles is removed, and the tool will swing in a 14-in. circle.

United States Electric Grinding Stands

The United States Electrical Tool Co., Cincinnati, Ohio, has just placed on the market two new electric grinding stands which are made in one- and two-horsepower capacities. These are driven by Westinghouse

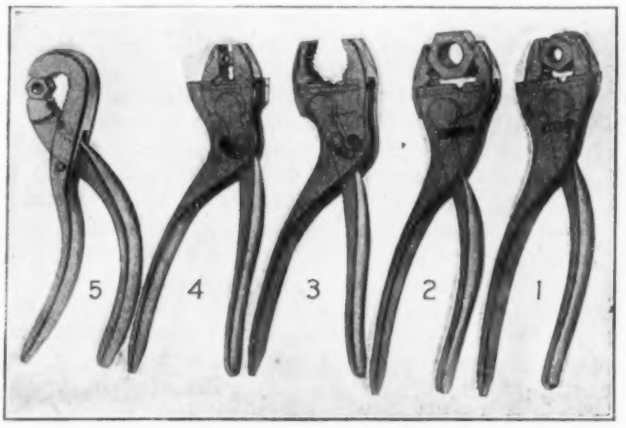


UNITED STATES GRINDING STAND

electric motors and can be furnished for direct current of 110 or 220 volts or alternating current of 220 or 440 volts, 60 or 25 cycles, for either two- or three-phase circuits. The weight of the smaller machine is 360 lb. while that of the larger is 480. The diameter of the emery wheel on the smaller machine is 10 in., and the diameter of the emery disk is 12 in. On the larger machine the diameter of the emery wheel is 12 in. with 1¼-in. face, and the diameter of the emery disk is 12 in. SKF ball bearings are used and ball-thrust bearings are fitted on the emery disk side of the motor to take care of the end thrust from the emery disk. The speed of the alternating-current machine is 1700 r.p.m. while that of the direct-current is 2000 r.p.m.

The Allen Plier Wrenches

The new series of plier wrenches shown in the accompanying illustration are being manufactured by A. C. Allen, 6441 Eggleston Ave., Chicago, Ill. The wrenches are convenient to manipulate, quick acting, and take a firm grip on the object clamped in the jaws. At any opening the jaws are parallel. The slotted opening for the fulcrum pin permits adjust-



ALLEN PLIER WRENCHES

ment for three sizes of openings. In wrenches Nos. 3 and 4 a different type of adjustment is used with a curved slot for the fulcrum pin. It is claimed that with these plier wrenches a ratchet motion may be obtained on nuts and pipes by releasing the handle and taking a new grip.

Slocomb Quantity-Production Micrometer

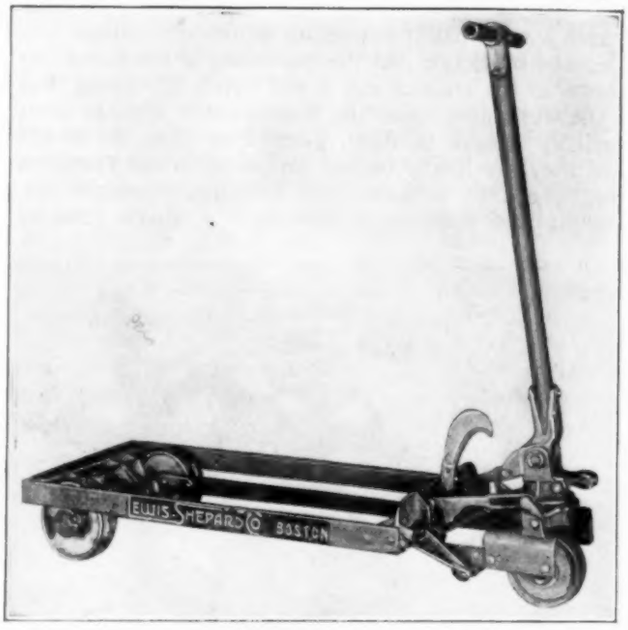
The quantity-production micrometer shown in the illustration is a recent product of the J. T. Slocomb Co., Providence, R. I., and is intended for use where a large number of pieces are to be made of one size,

SLOCOMB QUANTITY-PRODUCTION MICROMETER

the micrometer saving eye-strain and allowing accuracy in inspection. The graduated portion is clamped to the micrometer spindle and the indicator is clamped to the sleeve or stationary part of the micrometer, the attachment being so adjusted as to read zero at the correct size and 0.002 in. on each side, plus or minus. Because of the large diameter, the distance between graduations is increased three times, making the distance between the thousandth mark $\frac{3}{16}$ of an inch and allowing for the reading of ten-thousandths direct. The parts are made of aluminum for lightness and are furnished to read in half thousandths or in tenths of thousandths.

Lewis-Shepard Type M "Singlelift"

The Lewis-Shepard Co., 48 Binford St., Boston, Mass., has recently placed on the market the Type M "Singlelift" truck shown in the illustration. This is a light-duty model elevating truck, designed to handle loads up to 2000 lb. only, and the elevation of 2 in. is accomplished by one stroke of the handle. The truck is made in nine styles with heights lowered of 6, 7 and 9 in., and wheel diameters of 6, 7 and 9 in. The over-all lengths vary from 40 to 61½ in., the wheel bases from 31½ to 51½ in., while the lengths of the carrying platforms vary from 28 to 48 in. The weights vary from 140 to 170 lb. The truck has a lift of 2 in. and no release check is used, it being as easy to lower the load as it is to raise it. To raise the load it is simply



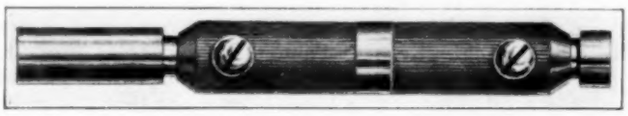
LEWIS-SHEPARD TYPE M "SINGLELIFT" TRUCK

Made in 9 styles. Heights lowered, 6, 7 and 9 in.; diameter of wheels, 6, 7 and 9 in.; width, 17½ in.; over-all lengths, 40 to 61½ in.; wheel bases, 31½ to 51½ in.; wheel face, 2½ in.; lengths of carrying platforms, 28 to 48 in.; net weights, 140 to 170 lb.

necessary to press the foot pedal which engages the lifting handle with the load. To lower the load, the pawl is thrown back with the foot but the load cannot be lowered until the operator takes the weight of the load on the handle to control its descent, this feature insuring that the operator must be ready to control the load before it can be lowered. It is stated that the locking device is so built that wear cannot reduce its effectiveness. The handle is always free for steering, whether in an upright or steering position or whether the truck is raised or lowered. The wheels have a face width of 2½ in. and run on Hyatt roller bearings, each being held in place by means of a single split pin.

American Double-End Detachable Plug Gage

The illustration shows a plug gage just introduced by the American Gage Co., Bridgeport, Conn. The handle is drilled through and drilled and reamed to a specified depth in each end to fit the shanks of the



DOUBLE-END DETACHABLE PLUG GAGE

plugs. The plugs are held in place by hardened-steel screws. The plug holes are countersunk to prevent difficulty from burring in case the gage was used with only one plug in place and roughly handled. The plugs are carried in stock heat-treated, seasoned and rough-ground, and are finish-ground and lapped to the customer's specifications when the order is received. It is claimed that the facilities of the factory are such that deliveries can be made almost as promptly as though the finished plugs were carried in stock.

The Smith Universal Radius Former

A grinding-wheel dresser, so made as to produce the proper form of wheel for grinding various radii, has just been introduced by the W. T. Smith Manufacturing Co., Bridgeport, Conn. It is known as a universal radius former and its main feature is a diamond holder mounted in a trunnioned yoke. The device is designed to cut a radius in less time than by the

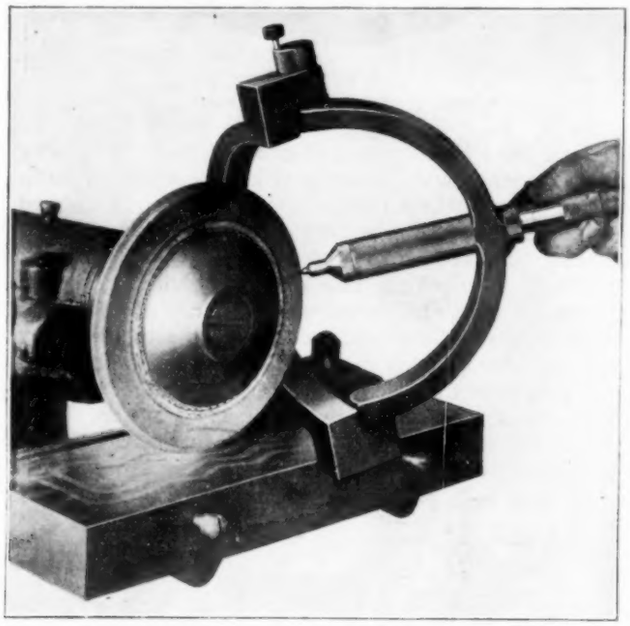


FIG. 1. SMITH UNIVERSAL RADIUS FORMER

old methods. In Fig. 1 the tool is shown set for cutting an inside or concave radius. To do this the diamond tool is pushed in so that it is beyond the trunnion centers of the movable member. For an outside or convex radius the point of the tool will be drawn back to the other side of the center line. In either case the exact radius is determined by the micrometer adjustment under the fingers of the operator, which is more clearly shown in Fig. 2. The micrometer is graduated in thousandths of an inch for radii from 0.030 to 3.500 in. The knurled housing which supports the diamond holder inside of the arc is supplied in several lengths which screw into each other and into the movable member so that no more than half an inch of the diamond

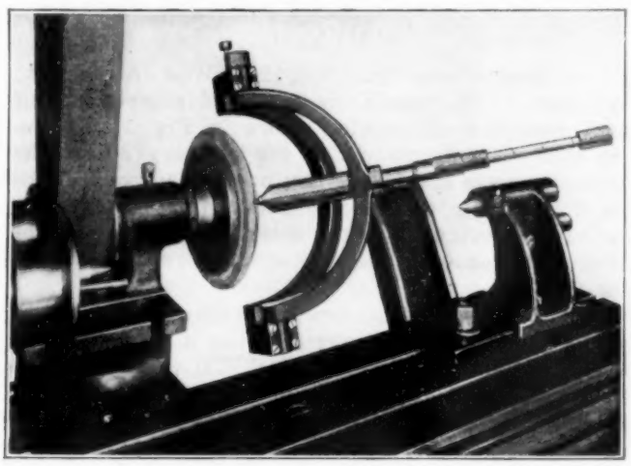


FIG. 2. CUTTING CONVEX RADIUS

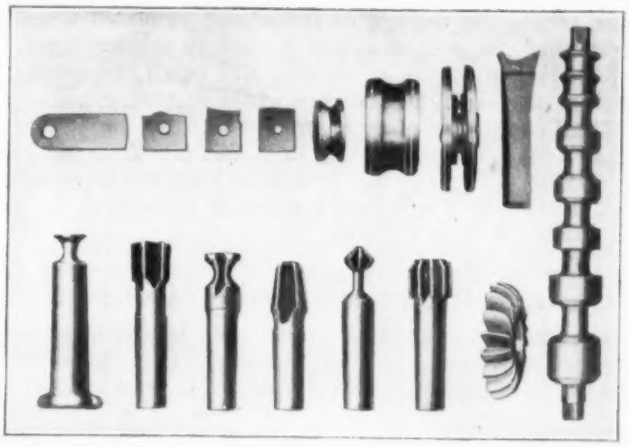


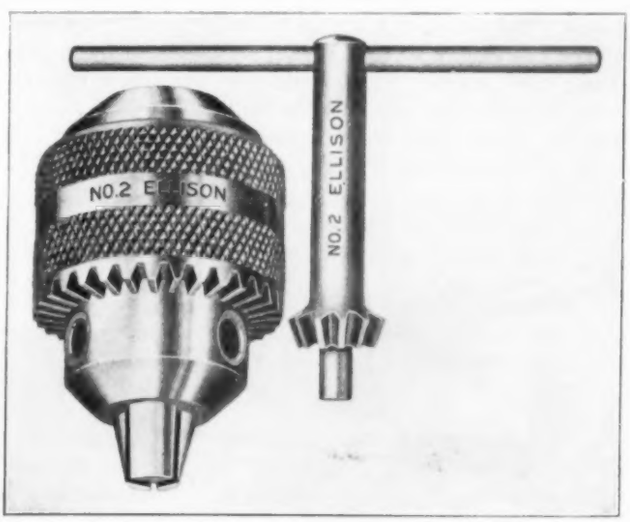
FIG. 3. SOME WORK DONE BY DRESSED WHEELS

holder need protrude from the supporting tube. By loosening the locknut back of the micrometer barrel, the holder rod may be moved in or out by half inches.

With the cutting point set to the correct radius on the micrometer scale it is only necessary to swing the movable arm through 90 deg. for a radius and through 180 deg. for a half circle. Thus no templet or cutter is required and the time of the operation is materially reduced. Fig. 3 shows some of the work which has been ground by wheels shaped with this tool.

The "Ellison" Drill Chuck

The chuck shown is made by the American Machine Co., 104 Wellington Ave., Hartford, Conn. The body and large, powerful jaws are proportioned to stand the strain of the largest drill within the capacity of the chuck. The jaws are accurately finished and placed in the body at an angle to give the maximum gripping power with the least mechanical effort applied to the sleeve. For this reason, the jaws are very easily tightened and released by hand for light work, or by means of the wrench for work requiring a strong, non-slipping grip. The upper ends of the jaws and the ring nut have accurately cut Acme threads, and the ring is hardened and ground. The sleeve is knurled and hardened and has accurately cut teeth in the lower end into which mesh the steel pinion teeth on the wrench. The



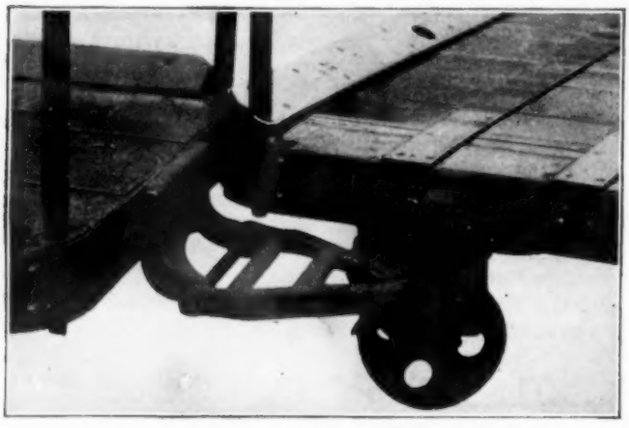
THE "ELLISON" DRILL CHUCK

holes into which the end of the wrench is placed when tightening the jaws are steel bushed to prevent wear and distortion. This gives long life to all the parts. Each part is carefully hardened where necessary.

These chucks are made at present in three sizes: No. 1 has a capacity for drills up to $\frac{7}{32}$ in.; No. 2, up to $\frac{11}{32}$ in. and No. 3, up to $\frac{17}{32}$ in. Two other sizes will be ready by July 1. No. 4 will have a capacity of from $\frac{1}{16}$ to $\frac{3}{4}$ in., and No. 5, from $\frac{3}{8}$ to $\frac{7}{8}$ in.

Carlton Industrial Trailer Coupler

The illustration shows a coupler built by the Lansing Co., Lansing, Mich., to join industrial trailers together and to the tractor drawing them. It is built of mal-



CARLTON INDUSTRIAL TRAILER COUPLER

leable iron and permits trucks to be operated at any angle up to 90 deg. to each other as shown. When uncoupled the drawbar clears the floor or remains up against the load when placed in that position.

Sanford Quick-Acting Cam Vise

A milling-machine vise which is operated without tools has been brought out by the F. C. Sanford Manufacturing Co., Bridgeport, Conn. It is shown in Fig. 1. The jaws are brought to the work by a chrome-nickel steel screw running in a steel floating nut and operated by a fluted handwheel. They are closed on the work by a quick-operating cam operated by the hand lever shown. The movement of the lever is from either side toward the center so that it may be operated by either hand. The screws which hold the jaws are readily accessible, thus making the changing of jaws a simple matter. The company is prepared to supply special jaws. The base and movable slide are made of semi-

FIG. 1. SANFORD QUICK-ACTING CAM VISE

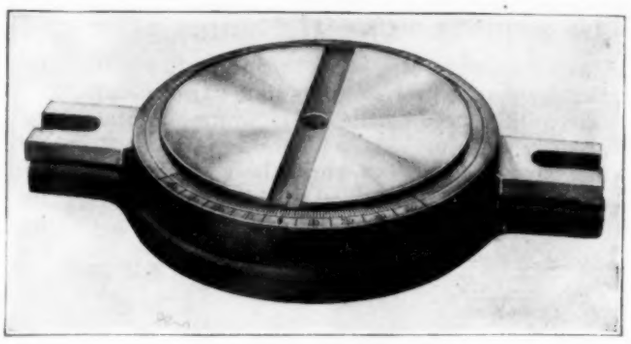


FIG. 2. SANFORD SWIVEL

steel and the slide, handle and gibs, of steel. The jaws are of hardened and ground tool steel. Accuracy sufficient to meet all the demands of the toolroom is claimed by the maker. Reciprocating parts are hand scraped, including the base in which key slots are provided fitted with hardened movable keys. The vise is clamped by a tee-bolt with hardened tee-slot nut.

Fig. 2 shows the swivel made by the same company which may be used for various purposes but is designed to be used with the vise described. The hold-down bolts are also used to lock the swivel in any position.

The Sanford company is also introducing the heavy-duty milling-machine vise shown in Fig. 3. This is an all-steel vise and is made for the heaviest work

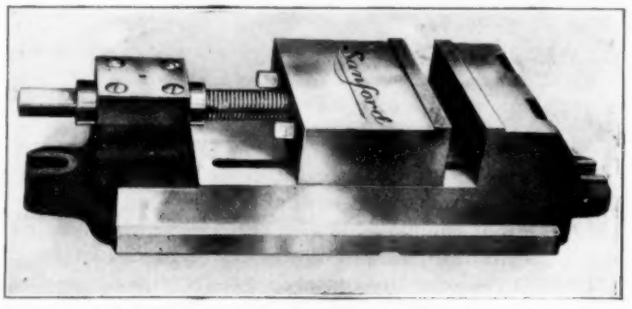


FIG. 3. SANFORD HEAVY-DUTY MILLING-MACHINE VISE

that a triple back-geared milling machine can handle. The movable jaw is operated by a 24-in. socket wrench working on a 1¼-in., 6-pitch, nickel-steel screw. This vise is made with either a 4-in. or 9-in. opening.

"Scusa" Micrometer Adjustable Snap Gage

The Lowry-Knise Tool Co., 211 West Adams St., Syracuse, N. Y., makes the combined adjustable-limit snap gage and micrometer shown in Fig. 1. It embodies the usual features of the ordinary adjustable-limit snap gage and in addition provides a ready means for determining the exact amount of stock to be removed to permit the piece to enter the limit gage. The possible time-saving features of this arrangement are obvious.

The micrometer attachment is similar in construction to the ordinary micrometer and has a ¼-in. diameter screw with 40 threads to the inch. It is graduated to thousandths and has a range of from $\frac{1}{8}$ to $\frac{3}{16}$ in. oversize. The screw is of tool steel with a positive stop on each end. The frame is made of cast iron with two strengthening ribs which afford an easy grip and

is finished in black enamel, baked on. The gage limit sizes are stamped on a detachable brass plate.

The two hardened measuring plugs on the same side with the micrometer head are ground and pressed into accurately reamed seats until they rest on two headless screws which are sealed in place. The three plugs on

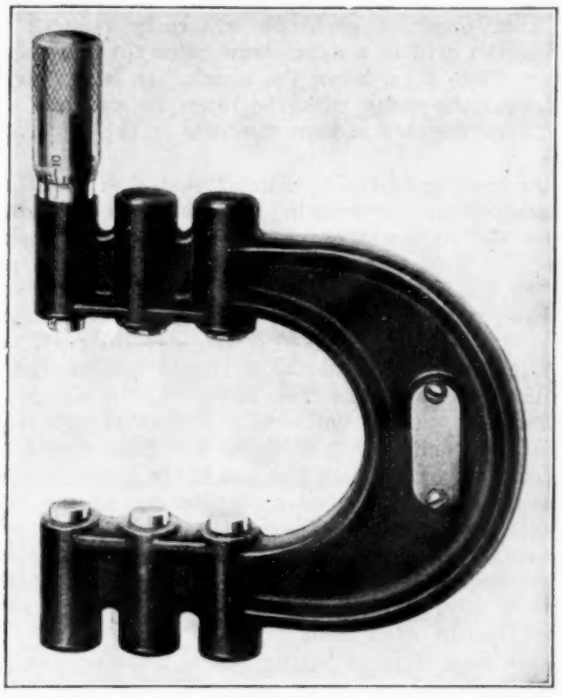


FIG. 1. "SCUSA" MICROMETER ADJUSTABLE SNAP GAGE

the opposite side, Fig. 2, are ground and lapped to have a tight friction fit in the frame and are provided with a device which includes the adjusting screw *B* and the lock screw *A*, giving an adjustment in both directions. The adjustment is made thus: Take two screwdrivers, one to fit *A* and the other *B*. Loosen *A* about

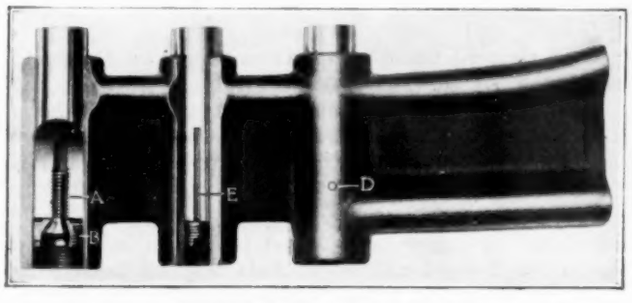


FIG. 2. CONSTRUCTION OF ADJUSTABLE PINS

one full turn. With the other screwdriver move *B* the required amount. Then tighten *A*. This tightening of *A* results in its taper head bringing the plug *C* to bear against *B* and also expanding *B* to make it a tight fit in the seat. The keyseat *E*, in connection with the pin *D*, prevents rotation of *C*.

Erratum

On page 917, the title in the middle of the left-hand column should read Horstmann Indicating Caliper and the title in the middle of the right-hand column, Bush Wiggler Attachment. Corresponding corrections have been made in our Condensed Clipping Index.

Edward Paul Reichhelm

Edward Paul Reichhelm, 24-26 John St., New York, died at his home in Bayonne, N. J., on Sunday, May 4, in his seventy-sixth year.

Mr. Reichhelm was the founder and president of E. P. Reichhelm & Co., Inc., New York, the American Gas Furnace Co., Elizabeth, N. J., and the American Swiss File and Tool Co., Elizabethport, N. J.

He came to this country with his parents at the age of five years, and after passing through the regular courses in school and academy, he studied mechanical

EDWARD PAUL REICHHELM

engineering in the evening school of Cooper Institute, while being engaged during the day as mechanic's apprentice with A. & F. Brown, machinists.

At the outbreak of the Civil War he enlisted in September, 1861, in the Third Missouri Infantry Regiment and became sergeant-major, advanced to the post of lieutenant in the Fifty-first U. S. Regiment and became regimental adjutant, captain, and subsequently major.

He established himself in the business of tools and supplies at 65 Nassau St., New York, in 1876, and organized the American Gas Furnace Co. in 1887. In the year 1900 he also organized the American Swiss File and Tool Co., in Elizabethport, N. J.

He was a member of the Loyal Legion, the Masonic Order, Cooper Union Alumni Association and the George H. Thomas Post No. 29, G. A. R. He fathered commission government in the State of New Jersey, and was president of the Park Commission of Bayonne, N. J.

The three business organizations established by him and built up from modest beginnings to their present high standing are a monument to his fine executive ability, indomitable energy and persistent purpose of acchievement in mechanical and industrial progress.

Salvaging Small Tools in the Machine Shop

By J. B. GRAY

While the salvaging of broken drills, cutters, and other such small tools is by no means a new thing, it required the high prices of raw material and the difficulty of obtaining new tools at any cost, brought about by war conditions, to teach us the possibilities in this direction. Once started, many apparently formidable obstacles proved to be insignificant, and a department installed as an emergency measure has now become a recognized auxiliary.

OF THE many economies the war has taught us, not the least important is the overhauling of our pile of scrapped tools, gages, jigs and cutters. I have had some experience with the scrap pile myself during and since the war, and have been able to reclaim at small expense many a tool that appeared to be hopelessly out of commission, including dies, gages, jigs, small tools, and even bench vises.

Many of these salvaged tools are in use now, and it would seem that a work which has proved to be so satisfactory while the war was in progress should not be lightly cast aside. More than once, some of our production departments have been kept running with salvaged tools, when it would otherwise have been necessary to shut down.

Every manufacturing plant of any size soon accumulates a scrap pile of worn-out and broken cutters, drills, reamers, counterbores, and the like, and I have found that a worth-while percentage of these can be reclaimed and put back in service.

The Man in Charge Should Be a Practical Toolmaker

The man in charge of this work must be first a thoroughly practical and resourceful toolmaker. He should know something of tool design to the end that his work when finished will be properly "balanced"; that is, where a new part is introduced, it must not be so large as to weaken the rest of the tool, nor must it be so light as to be too weak itself. A knowledge of carbon and high-speed steels is also necessary for the reason that if a part or a cutter must be replaced with a material different from the original, the salvage man should know exactly what material to use. Another qualification is that he should be an accurate and rapid draftsman, to enable him to get his ideas on paper actually "while you wait," to the end that his men and machines may not be idle. He must thoroughly understand packhardening, cyaniding, the heat-treatment of machinery steel and the various low grades of alloy steels in general as well as the hardening and tempering of high-carbon and high-speed steel. Unless he thoroughly understands this part many failures will result, not only in wasted time but in the possible shutdown of production machinery.

At one time we had considerable trouble with drills breaking about an inch or so below the shank and all we could use the shanks for was to make small centers for lathes and other purposes. When the drill happened to be of high-speed steel, we would anneal the stub, shank and all, drill a hole in the center 2 in. deep, then drive in a piece of hardened drill-rod and grind it with the toolpost grinding device. We found, however, that breakage could be materially reduced by drawing the drill to a dark straw color for a distance of from 1½ to 2 in. below the shank. In larger drills there would be many with the tangs twisted off, and many large reamers and counterbores in the same condition.

After proving to the "old man" that they could not be "saddled," or "tongued in" and welded satisfactorily because the lightness of metal beside the slot would permit the weld to open up, and also they would run "out" so much that we could not spare the stock from the shank to grind them true, we salvaged them in this way: The drill was chucked at the straight part, just below the shank, and the shank run in the steadyrest. The damaged tang was then faced off, the shank recentered and turned down to the next smaller size. An ordinary drill socket or sleeve was then shrunk on, the sleeve of course being the size of the original taper. It was driven down against a shoulder left on the large end of the old shank. The final operation is to drill for a drive pin between the end of the drill-socket and the shoulder. Reamers and counterbores are treated the same way. It will be found cheaper to use stock sleeves than to make them.

In the case of large boring heads, however, say No. 5 or 6 Morse shanks, it is preferable to turn the old shank down parallel, bore a piece of stock to drive on, and turn a new shank. We have salvaged large boring-head shanks in this way, the heads carrying six to eight stellite cutters, and used for boring large cylinders for motor trucks. They have been back on the job for months and are still working satisfactorily.

The Recutting Method

Side-milling cutters up to 6 in. x ¾ in. are usually made solid, and in order to provide sufficient chip clearance we thought the distance from the cutting edge to the bottom of the side teeth should not be less than ⅜ in. The way we recut these teeth is to take a fairly coarse grinding wheel and dress it to shape by hand (a diamond makes the wheel too smooth and it burns the work too readily). We then bolt a stud to the grinding-machine table, place the cutter on it, and index with a finger, also bolted to the table. A boy should recut eight cutters in this way on both sides in 10 hours, using a No. 1½ Cincinnati tool-grinding, or other similar machine.

After being recut once or twice, it will be found that the web must be thinned if the cutter is to be recut again, and the best way to do this is to anneal the entire cutter and face it down in the lathe; it doesn't pay to attempt to grind it.

Spiral cutters also can be very handily recut on the tool-grinding machine; simply run the job on centers, index from the head, and swivel the head same as you would to mill a spiral, only turn the head to the angle instead of swiveling the table as in milling. A left-hand spiral can be as readily recut as a right-hand one.

Broken end mills can nearly always be saved; small ones can be annealed and filed, then ground to the next

size smaller, while the larger ones can be cut off with an elastic wheel, and the end teeth recut in the same way as described for recutting a side cutter.

A tool that seems altogether hopeless may often be used for something else. For example, reamer bodies can be made into arbors, mandrels, various sorts of machine handles, tap wrenches, handles for small die-stocks, etc. Drill shanks make good centers, either male or female. Mandrels that are beyond repair can be annealed and made into lathe centers, or if they are machine-steel, may be made into stock for plug gages. We often make such plug gages and packharden them.

Foreign Selling Agencies

BY ROBERT ALTER

This article contains some comments and advice regarding foreign selling agents by a man especially qualified to write on the subject. He has long been foreign manager and vice president of the American Tool Works Co., Cincinnati, Ohio; is honorary vice president of the National Foreign Trade Council, and president of the Foreign Trade Association of Cincinnati.

IF OUR foreign customers and business friends in other countries could have had the opportunity of attending the impressive meetings of the National Foreign Trade Convention and the Mississippi Valley Association, their trade tendencies would gravitate toward us as never before: (1) Because they would realize how fully we Americans appreciate their patronage and coöperation; (2) how sincerely we sympathize with them in the many difficulties that have surrounded them, due to the unsettled conditions brought about by the war; (3) how much better we understand them from not only a business but a social standpoint; (4) how willing we are to give them the best we have at the lowest possible prices and on terms that are as good from an economical standpoint as any other country in the world.

True, the war has brought much additional money to the United States of America, but we realize that this additional money has really come, to a large extent, from our friends and business associates in the countries with which we have been coöperating during the war. Conditions have brought about high prices due to many causes, and for this reason the volume of money in America is greater than would have been the case had prices been able to stay normal on a pre-war basis.

While this additional money is here, yet the attitude of every fair-minded business man is that this surplus should be used not only in developing the trade relationships between this country and others, but also to help those industrial organizations in other lands which have in the past given such good service to the Americans in pushing their trade and also to those who contemplated specializing in the sale of American products. This money can be used to advantage in this way through several channels, such as buying foreign securities, extending longer credits and making substantial loans, not only to foreign countries, but to foreign industrial enterprises.

The new American merchant marine will most certainly be operated to the advantage of our foreign customers not only in giving the lowest possible cost in ocean transportation, but also in establishing definite reliable sailing schedules, so that delivery of orders placed in America may be accomplished at definite reliable periods.

Much is being said about the operation of the Webb-Pomerene Bill, which allows combination and price regulation for American manufacturers in foreign trade. There is a lurking danger in the publicity being given to activities along these lines. Americans wishing to operate under this new legislation should not and will not do so in the spirit of animosity toward dealers in similar lines in foreign countries.

The foreign dealer and customer may be seriously concerned over the passage of this bill in feeling that the services of the dealers and the patronage of the customers has not been fully appreciated by us Americans. This is an erroneous idea. The true American never forgets a service rendered, and we Americans who have had the opportunity of realizing from personal contact the efforts that have been expended by foreign dealers in pushing our goods in their respective countries will use our influence to maintain their confidence and to educate the newcomer in American foreign trade to respect the foreign dealer who has been loyal to us, who has been the sole medium for making our foreign trade up to the present time.

As interest in organizing purely American selling organizations for foreign trade is keener at this time than ever before in the history of the country, such organizations are liable to spring into being at any time and in any number. It is well, therefore, to point out for the benefit of our old reliable representatives in foreign countries of foreign nationality that they should not feel in their hearts a spirit of antagonism toward these new American selling organizations, because they will find them good neighbors and well worth cultivating, especially in a social way.

It should be pointed out to foreign dealers that the old attitude of considering a competitor as your enemy is fast disappearing. The fallacy of this attitude has been demonstrated in America, and the evolution from this deplorable attitude has been brought about largely by the social intercourse in the American club and the now prevalent practice of conferences between competitors to bring about conditions which will help them all.

The foreign dealer, therefore, should not draw back from any American selling organization which may appear in his country, but it would be well to bring about a meeting whereby a better understanding of each other, their aims and difficulties can be had.

The new American selling organizations can be of great assistance even to the old established firms in foreign countries, not only in placing them in touch with American lines which they might care to represent, but also to prevent useless losses and suicidal price cutting.

Furthermore, these American organizations can give information to our foreign friends about American markets desiring material of all kinds from their countries. Therefore, let us all work together to help each other in reciprocal trade between our respective countries and in this way the most admirable relationship will be established.

Sapolio for Grinding and Lapping

BY R. B. FRANK

A good material to use for grinding or lapping in surfaces, where a good joint is required, is pulverized sapolio and water. The shaft or other part is set in place and the mixture liberally poured on while the part is in motion. In this way a true surface may be made and after the grinding is finished all particles of grit can be washed away. If emery is used the grinding is done faster, but the particles of emery cannot be entirely removed, and they are continually cutting.

Sparks from the

Exporting Opportunities in South America

Chile, Peru and Ecuador Offer Good Opportunities for Doing Splendid Export Business in Construction Materials

The requirements for construction materials and machinery in Chile, Peru and Ecuador are set forth in detail in a book of 200 pages just published by the Bureau of Foreign and Domestic Commerce, Department of Commerce. It is a report made by W. W. Ewing, trade commissioner of the Bureau, who was sent to study these markets at first hand for the Government.

It appears that there is much construction and building work going on in Chile, where the public works department has considerable work in hand. As an instance, there were studies for railway work nearly completed at the time the report was made amounting to over $12,000,000. During 1917, 35 projects with an estimated cost of over a million dollars were finished. Of these, five were for water supplies, six for repairs to wharves, three for repairs to jetties, four for wharves and sea walls, and twelve for sewers.

There was also begun 13 additional projects in 1917 and the public works department had under inspection the execution of 25 contracts of a total value of $887,538. There was also a considerable amount of irrigation work under way.

The author of the reports states that American manufactures are generally as good as those of Europe, and in some cases better. Some of the articles of American make that enjoy a preference in Chile are door locks, padlocks, hinges, iron and wire nails, tacks, lumber for construction and cabinet work, turpentine, varnishes, enamels, and many other articles that are not imported in large quantities.

There are certain basic paint materials, such as zinc and linseed oil, as well as marine paints, in which England has the preference.

The Chilean public is generally favorably impressed with American goods and considers them more up to date than the European articles.

During the past decade sanitation in Chile has made great progress. It is estimated that 15,000 fixtures, including enameled and porcelain bathtubs, water-closets, and lavatories are imported annually. There has also been a steady demand for heating installations, hot water being the system most favored.

There are many things requiring development—the railroads, the enormous hydraulic assets, the vast wealth in nitrate, the copper and other mines, the agriculture resources, and the great forests of the south.

With the development of its hydraulic power the central section of Chile may become a great manufacturing center. With the investment of capital, the application of American talent, and the use of Chilean labor, good returns may be had.

War Has Enriched the Peruvians

The time is ripe in Peru for the sale of construction materials, and there are possibilities of making some good contracts. The country has entered upon a period of prosperity. The government is progressive. The war has enriched the Peruvians who, a little uncertain how to invest their gains, are in many instances buying up lands and old houses and are preparing to rebuild with modern structures possessing all sanitary conveniences.

The financial condition of the Peruvian government has been greatly improved, the income having increased more than 30 per cent., the result being that work has been commenced on several new public buildings and it is expected that work on others will soon follow.

Impetus is being added to this activity by the fact that on July 28, 1921, the centennial of the independence of Peru will be celebrated, and it is proposed to have finished by that time the Judicial Palace, the Legislative Palace, the Archibishops' Palace, the model jail, the Prefecture, an orphan asylum, and a hospital for women.

* * *

Cutting Steel Under Water

It is stated that a French company has for some months past used an oxy-acetylene blowpipe of special construction to effect the cutting of steel under water. The apparatus consists of a cutting blowpipe based on the same principles as the ordinary one, but supplemented with a small diving-bell, to which compressed air is admitted to expel the water. The pressures of the oxygen and acetylene required are much higher than those usually employed; the pressure of compressed air depending upon the depth at which the blowpipe is worked. At the trials now being carried out, ships' plates have been cut at a depth of 27 ft. under water. The application to marine purposes of this system of cutting plates has obvious advantages. By its aid the salvaging of torpedoed vessels may be facilitated, and rapid repairs to lock gates can be effected. The electric arc can be manipulated in the same manner, but requires special electrodes and extra illumination.

Engineering Society of Western Massachusetts

A dinner and organization meeting of the Engineering Society of Western Massachusetts was held at the Hotel Kimball, Springfield, Mass., on Wednesday evening, Apr. 16. The following officers were elected: Charles L. Newcomb, president; C. C. Chesney, vice president; George E. Williamson, vice president, and Winfield E. Holmes, secretary and treasurer.

The constitution and by-laws provide for four grades of members, an entrance fee of five dollars and annual dues of the same amount.

The speakers included Prof. L. P. Breckenridge, William Spencer Murray, and Dr. George Otis Smith. Over 300 persons attended the dinner and nearly 1100 applications for membership were presented.

* * *

Will Manufacture Low-Priced Automobiles in France

A determined effort is being made to manufacture low-priced automobiles in France, and it may be expected that every protection will be afforded this industry. The important munition plant at Citroen has been transformed into a factory designed to develop a 10-hp., 4-cylinder machine, consuming 2 gal. of gasoline per 62 mi. Its chassis weighs 882 lb. and the machine is supposed to develop a speed of 40 mi. an hour. The importance of this industry will be realized from the fact that material for the construction of the first 30,000 chassis is now being worked, and that the machines are beginning to appear on the market.

The price of these cars will be $1400 to $1700, according to the type; that is, torpedo shape (for three or four passengers), sedan, etc. All equipment and accessories are included in the above-mentioned prices. The plan of the organization of this factory is based on American methods.

* * *

Tractors Shipped From Canada

Figures compiled by Dominion authorities show that more than 8000 tractors were shipped into Canada by United States manufacturers during December and January. During the year 1918, 21,691 American-built tractors were exported to Canada, 12,805 in 1917 and 3693 in 1916. There is no import duty on tractors, and it is believed there will be none for the remainder of the year. Canadian tractor makers, however, are insisting on the replacement of the import duty, as but a few hundred tractors were made in Canada during 1918, chiefly because of American competition.

World's Industrial Forge

By E.C.Porter
News Editor

Tractor Imports to France To Stop July 1

Agricultural tractor imports into France will be prohibited on July 1, if French makers are in a position to meet national requirements, is the official statement made by Minister of Ravitaillement Boret.

At the present time not only are tractor imports permitted, but the government is buying American machines and selling them to groups of French farmers. In addition to this, as has already been said, the ministry of agriculture is offering a subsidy equal to half the cost of the machine to purchasers of tractors who give the necessary guarantees that the tractors will be kept at work.

It is doubtful if the French makers will be in a position to meet requirements by the date indicated. The biggest producers at the present time are Renault, De Dion-Bouton, and Latil, but others who are rapidly getting into production are Peugeot, Schneider, Paris General Omnibus Co., Delahaye and Gnome & Rhône.

* * *

Machine Tool Convention Speakers

The speakers at the convention of the National Machine Tool Builders Association, held at Atlantic City, N. J., May 12-13 were Mark Sullivan, of Collier's Weekly, on "Personal Experience at the Peace Conference," and Chas. F. Lang, president of the Lakewood Engineering Co., Cleveland, Ohio, on "Coöperation."

Full details of the meeting will be published next week.

* * *

Definitions of Diesel and Semi-Diesel Engines

In its issue of Mar. 21, *Engineering* (London) published an account of a meeting of the Diesel Engine Users' Association, and announced that, as a result of papers and discussion, the association has approved and is now circulating among its members the following definitions of Diesel and semi-Diesel engines.

A Diesel engine is a prime mover actuated by the gases resulting from the combustion of a liquid or pulverized fuel injected in a fine state of subdivision into the engine cylinder at or about the conclusion of a compression stroke. The heat generated by the compression to a high temperature of air within the cylinder is the sole means of igniting the charge. The combustion of the charge proceeds at, or approximately at, constant pressure.

A semi-Diesel engine is a prime mover actuated by the gases resulting from the combustion of a hydrocarbon oil. A charge of oil is injected in the form of a spray into a combustion space open to the cylinder of the engine at or about the time of maximum compression in the cylinder. The heat derived from an uncooled portion of the combustion chamber, together with the heat generated by the compression of air to a moderate temperature, ignites the charge. The combustion of the charge takes place at, or approximately at, constant volume.

* * *

Compelled To Seek Material From America

At the annual meeting of the Scottish Tube Co., Ltd., in Glasgow, the chairman said that in order to keep the works going they were compelled to seek supplies of material from America, where the works were able to supply suitable steel for tube-making at a considerably lower price than home makers.

* * *

New Cuban Engineering Society

There was established in Havana on the evening of Feb. 21 the Association of Members of American National Engineering Societies in Cuba. This organization restricts its membership to persons who are members of the following American national engineering societies: The American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Institute of Chemical Engineers, the American Society of Agricultural Engineers, the American Society of Refrigerating Engineers, the American Institute of Mining and Metallurgical Engineers, the American Institute of Architects, the American Iron and Steel Institute, and the American Chemical Society.

There will be four regular meetings each year, one of which will be the annual meeting, occurring on the second Friday of December. The headquarters of the society are located at No. 17 Empedrado, Havana.

The officers for the coming year are Luther Wagoner, president; George H. Nolan, vice president; T. Carlile Ulbricht, secretary, and Wallace R. Lee, treasurer.

* * *

Statistics Given at the International Conference in New York

The last reports from England give the number of men totally blinded in the war as 1415; Belgium reports only 28, Canada 120, and the United States (according to Major Henderson, of Fort McHenry) 75.

Government Will Dispose of Surplus Materials

Committee Representing the Trade and Technical Papers Hold Conference With Director of Sales in Washington

The general policies of the War Department in the disposal of surplus property were enunciated by C. W. Hare, Director of Sales, to a committee representing the trade and technical papers of the country, at a recent meeting in his office in the Munitions Building, Washington.

Those present were: Mason Britton, chairman, McGraw-Hill Co., New York; A. C. Pearson, president of the Associated Business Papers, Inc.; V. E. Carroll, chairman of the New York Editorial Conference; A. I. Findlay, editor of *Iron Age*, New York; David Beecroft, editorial director of the Class Journal Co.; Jesse H. Neal, executive secretary of the Associated Business Papers, Inc., New York.

In addition to C. W. Hare, there were present from his department, E. C. Morse, Assistant Director of Sales; T. R. Elcock, Chief of the Sales Promotion Section; and L. G. Chapin, Assistant Chief Sales Promotion Section.

Mr. Hare stated that the War Department would dispose of its surplus materials by first consulting with the various branches of the Government to ascertain if any could be utilized in regular Government work. After the Government requirements have been satisfied, the producers of each particular commodity will be called into conference to advise with the Director of Sales as to the best method of getting the remaining amount of the commodity back into the usual channels of trade.

If, as has been the case in the disposal of copper, sulphur, lead, wool and lumber surplus stocks, the industry is able to contract with the Government to dispose of its surplus within a reasonable length of time, paying the Government the current market prices, it would be the policy of the Government to make such an arrangement.

Should both of the methods mentioned fail, the surplus property will be offered to the general public through auction sales, or by sealed bids, or in any other manner which will enable the Government to obtain the best prices.

A Sales Promotion Section has been established under the supervision of T. R. Elcock, Jr., to collect all information pertaining to the disposition of surplus property and to see that appropriate information reaches interested industries through the proper trade and technical papers.

Business Items

Ogden R. Adams, Rochester, N. Y., has moved his showroom and office to 244-246 St. Paul St., Rochester, N. Y. The new location affords much larger office and showroom space.

The Neptune Meter Co., of New York, has acquired a building from the Russell Motor Car Co., of Toronto, Ontario, Can., in which it intends to manufacture Trident Water Meters for Canadian trade.

Oliver Machinery Co., of Grand Rapids, Mich., has opened a new office at Chicago, Ill., owing to the increase of business and manufacture. It is located at 810 Railway Exchange Bldg., Jackson and Michigan Blvds. Inquiries for pattern-shop equipment, woodworking machinery, engine lathes, as well as equipment for industrial and vocational schools, in the Chicago district, should be addressed to the new office.

Paul W. Koch & Co. has been organized to take over the charter of the Electrical Sales Engineers, Inc. and to combine that company with Koch and Sandidge. The new officers are as follows: President, Paul W. Koch; vice president, R. A. Alderman; secretary, M. E. Gaffney; treasurer, M. S. Koch. The new company will act as Chicago district representative of the Condit Electrical Manufacturing Co., South Boston, Mass., the Esterline Co., Indianapolis, Ind., and Lewis and Roth Corporation, Philadelphia, Penn.

The Black & Decker Manufacturing Co., Baltimore, Md., has recently established a New York office in the Equitable Building, which will be in charge of G. H. Lundane. Mr. Lundane was formerly connected with the Thomas B. Jeffery Co., Kenosha, Wis., and the Findeisen & Kropf Manufacturing Co., Chicago, Ill. The Black & Decker Manufacturing Co. has branches in New York, Philadelphia, Atlanta, San Francisco, Chicago, Detroit, Columbus, Buffalo and Boston, the general office being located at Baltimore. It also has connections in England, France, Norway, Sweden and Japan.

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Speakers and Subjects at the Pittsburgh Convention

The speakers at the joint convention of the National Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association being held in Pittsburgh this week are George N. Peek and Samuel P. Bush of the Industrial Board, U. S. Department of Commerce. Some of the subjects of other speakers are "Employment Relations from a Manufacturer's Viewpoint," Stephen C. Mason; "Business Outlook," H L. Humphrey; "The Steel Situation," S. E. Hackett; "Price Guarantees," Severir P. Ker; "Combination and the Manufacturer," James A. Emery.

Trade Currents

Cleveland Letter

The turn of the month has brought marked improvement into the machinery and machine-tool market in northern Ohio. The last week has been significant in the development of more inquiries and more orders than was noticeable in any similar period during the entire month of April. This improvement, however, is not general, but is taken as an indication of what may be expected by the trade here for the immediate future. While the demand is still quite general, there seems to be a greater interest in radial drilling machines, lathes, automatic screw machines, and milling machines, with automatic screw machines perhaps heading the list.

In one quarter the last week's business is reported to be 100 per cent. greater than any week during April. In other quarters there are more inquiries than for many weeks past, which is taken as a good sign. The only drawback to good business, in the opinion of some leaders in the industry, is the disposition on the part of purchasers to refrain from quick closing of their orders.

The chief factor that the trade in this section will have to contend with during the immediate future, leading distributors and manufacturers point out, is the surplus of Government-owned machinery on the market. This is hitting manufacturers more than dealers. In this territory several large distributing interests have taken over plants where Government machinery had been used; in some instances only a few months, and as the average asking price of these items is 50 per cent. below that necessarily asked for new equipment, it is naturally finding a readier outlet, especially as much of the machinery offered is in excellent condition.

Chicago Letter

Trade among machine-tool dealers in Chicago continues excellent, with no indication of an immediate let-up. Shops needing tools to fill definite requirements are placing orders freely and, while some larger buyers are holding in the apparent hope of lower prices, actual sales are in sufficient volume to indicate that May is going to be at least as good as April. A conservative estimate would place present sales in this district at $250,000 a week.

The wide range covered by present activity is indicated by the following representative sales made in the last week: One No. 4 Kempsmith milling machine; one 30 in. x 24 ft. W. & S. lathe; two 7-ft. boring mills; one 72-in. boring mill; one 52-in. boring mill; one 18-ft. x 36-in. lathe; eight power presses, various sizes; seven engine lathes, ranging in size from 14-in. to 18-in. swing; several multiple-spindle drilling, milling and shaping machines; an extra large Duplex horizontal boring, milling and drilling machine.

Personals

PAUL H. SCHATZMANN, of Joseph T. Ryerson & Son, Chicago, Ill., sailed for Rio de Janeiro to take care of its South American interests.

MARCEL E. CARTIER, of Joseph T Ryerson & Son, Chicago, Ill., sailed for France after a few weeks' visit in this country. He will continue to look after the company's foreign interests.

JOHN H. ROMANN, of Joseph T. Ryerson & Son, Chicago, Ill., recently sailed for France to look after its interests in France, Belgium, Holland, Switzerland, Italy, Spain and Portugal.

PETER A. FRASSE Co., New York, has announced the appointment of C. W. Jacoby as manager of the Philadelphia office and warehouse. Mr. Jacoby succeeds W. F. Moore who has recently resigned.

LIEUT. LAMBERT G. NEFF who has been with the Aviation Corps since the beginning of the war, has been released and has returned to the S. A. Potter Tool and Machine Works, 79 E. 130th St., New York.

A. L. G. GENTLES, of Joseph T. Ryerson & Son, Chicago, Ill., will establish headquarters in London, to take care of its interests in Great Britain and Scandinavia. He will sail about the end of May.

HALE D. JUDSON, city engineer of St. Joseph, Mo., has resigned to accept a position with the engineering department of the Missouri State Highway Commission. Mr. Judson has been city engineer since December, 1918.

T. J. HUDSON has been appointed acting manager of the Chicago Pneumatic Tool sales division, succeeding F. H. Waldron, who returns to Minneapolis, Minn., as district manager of sales for the Minneapolis territory.

LIEUT. R. A. FISHER, U. S. N. R. F., for the last 18 months connected with the flying corps, has joined the sales and engineering force of the J. R. Stone Tool and Supply Co., Detroit, Mich. Lieutenant Fisher, before entering the service, was connected with the Curtis Aircraft Corp. and the Continental Motors Corp., Detroit and Muskegon, Mich.

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Reconstruction Information Offered to Industry

The reconstruction research division of the National Defense Council is now ready to give the business world whatever information relative to reconstruction it has been able to compile. The division has charge of all the Federal official bodies and has access to information relative to foreign reconstruction activities and also data relative to domestic business, which has been gathered during the war by the various war-administration boards. Manufacturers who are desirous of obtaining any of this information can do so by applying to the committee.